BULLETIN OF THE
VANDERBILT MARINE MUSEUM

VOLUME III

Scientific Results of the Cruises of the Yachts "Eagle" and "Ara", 1921-1928, William K. Vanderbilt, Commanding.

CRUSTACEA: ANOMURA, MACRURA, SCHIZOPODA, ISOPODA, AMPHIPODA, MYSIDACEA, CIRRIPEDIA, AND COPEPODA

By LEE BOONE

Library,
U. S. Fisheries Biological Station,
Seattle, Washington.

ANNOUNCEMENT.

The Vanderbilt Marine Museum is the privately owned depository of the marine collections of William K. Vanderbilt, Esquire, and is located on his country estate, "Eagle's Nest," Huntington, Long Island, New York. It contains extensive collections of natural history and ethnological specimens, all of which were personally collected by Mr. Vanderbilt, in various parts of the world during the past thirty-odd years.

The scientific publications of the museum consist of a series of Bulletins, designed to disseminate results of research based on the marine zoological collections, every specimen of which was personally collected by Mr. Vanderbilt, during a series of cruises in his yachts "Eagle" and "Ara." Volume I of the Bulletin series consists of reports on the fishes collected during these cruises, by Dr. N. A. Borodin. Volume II consists of a report of the Stomatopod and Brachyuran Crustacea of the cruises of the yachts "Eagle" and "Ara," 1921–1928, by Lee Boone.

Volume, III, the present report, consists of a report of the Crustacea: Anomura, Macrura, Schizopoda, Isopoda, Amphipoda, Mysidacea, Cirripedia and Copepoda of the Cruises of the yachts "Eagle" and "Ara," 1921–1928, by Lee Boone.

These Bulletins are available for distribution to scientific establishments by purchase, or by exchange for equivalent research reports in related subjects. They may be obtained by addressing Mr. Vanderbilt at the Vanderbilt Marine Museum, Huntington, Long Island, N. Y.

Other bulletins will be issued from time to time, as made desirable by the results of research on the Vanderbilt collections. An additional volume is now in press.

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PREFACE.

The various expeditions of the "Eagle" and the "Ara" under the leadership of William K. Vanderbilt constitute another link in the long series of noteworthy explorations which have added to our knowledge of the oceans of the world.

Such voyages may be divided into two categories: first, the expeditions initiated and carried out under govermental auspices, and, secondly, those due to the leadership and munificence of private individuals.

Most of the great oceanic expeditions of the past half century have been undertaken by professional scientists and navigators, and as national enterprises. More recently, the lure which clings to the great areas of the deep, as yet unexplored, has attracted the attention of men who, like Mr. Vanderbilt, are able to devote their own resources and energy to this problem. The adequate equipment of such a vessel as the "Ara" with dredges, trawls, sounding apparatus and other instruments fitted for both shallow water observations and those of greater oceanic depths is no small task. Mr. Vanderbilt's success as navigator and explorer, and his appreciation of the significance of the scientific opportunities of his voyages are amply attested by the extensive marine collections brought back by him and by the energy and enthusiasm with which he has pushed their display in the Vanderbilt Marine Museum and in the scientific investigations and publications based upon them.

The attractively written and beautifully illustrated narratives of the voyages to the Galapagos and around the world on the "Ara" are greatly appreciated additions to the literature of oceanic voyages. The present volume, by Miss Lee Boone, is the third volume on the more technical results of his expeditions, and, together with a companion volume already published, is devoted to the important Crustacean collections. It is a noteworthy illustration of the contribution which can be made to the scientific exploration of the seas by one who reckons himself an amateur, and yet whose devotion to science impels him to place at its disposal his energy and resources with such outstanding results.

HENRY FAIRFIELD OSBORN.

American Museum of Natural History,
October 10th, 1930.

To my Mother.

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CRUSTACEA: ANOMURA, MACRURA, SCHIZOPODA, ISOPODA, AMPHIPODA, MYSIDACEA, CIRRIPEDIA AND COPEPODA,

CRUISES OF THE "EAGLE" AND "ARA," 1921-1928, WILLIAM K. VANDERBILT, COMMANDING.

By Lee Boone.

Introduction.

The Crustacean collection of the Vanderbilt Marine Museum was obtained by Mr. William K. Vanderbilt on a series of cruises conducted in his yachts, *"Eagle"* and *"Ara,"* during parts of the years 1921 to 1928, inclusive. The report on the Stomatopoda and Brachyuran Crustacea collected on these expeditions comprises Volume II of the bulletin series of the Vanderbilt Marine Museum. The Anomura, Macrura, Schizopoda, Isopoda, Amphipoda, Mysidacea, Cirripedia and Copepoda form the subject of the present volume.

Four distinctly separate faunal regions are involved in these explorations: (*a*) The West Indian region, from which the greater percentage of species was obtained. Separate cruises during the years 1921, 1922, 1923, 1924 and 1925 were conducted by Mr. Vanderbilt in this region. Some very valuable material was obtained in the West Indies in 1926 and also in 1928, supplementing the Galapagan expeditions of those years.

(*b*) The Labrador-New England region is represented by material collected in the waters of Newfoundland, Nova Scotia, eastern Canada, the coast of Maine and of New York, including Long Island Sound, in 1921, 1922, 1924 and 1926.

(*c*) The tropical American Pacific fauna is represented by explorations in the Galapagos Islands, the west coast of Costa Rica and of Panama, including the Perlas Islands, and Cocos Island, also several deep-sea stations in this region, during the expeditions of 1926 and 1928.

(*d*) The Mediterranean fauna, with especial reference to the north coasts of Morocco, deep-sea dredgings off the coast of southern France, off Sardinia and off Monaco and explorations of the littoral fauna of the Adriatic Sea.

The bathymetric distribution of the species taken in each of these major regions ranges from terrestrial and littoral to true deep-sea forms, the deep-sea stations ranging in depth from 300 to 1100 fathoms. The annotated discussion of the collection is presented with reference to its systematic classification. A list of the species found in each major faunal region is given also.

The great value of the collection lies in the astonishing number of rare species it possesses and in the related extension of our knowledge of the geographic and bathymetric distribution of these forms, as presented in the systematic discussion. Much hitherto unpublished data on the colors of the various species was made in field-sketches by Mr. Vanderbilt, during all of the cruises, except those to the Galapagos Islands, on which his staff artist, Mr. W. E. Belanske, continued this work under Mr. Vanderbilt's direction. A few of these color plates of the Crustacea have been published in Mr. Vanderbilt's "To the Galapagos on the '*Ara*' "; a great many more are in the study collections of the Vanderbilt Marine Museum. This volume also contains complete maps of the cruises of 1926 and 1928. Valuable notes on the habits of some of the species were made in the field by Mr. Vanderbilt; these notes have been augmented by field-notes made by the present writer while on various expeditions during the past decade.

Although the United States was the pioneer in deep-sea exploration it is an astounding fact that we know less today of the living inhabitants of our ocean depths than we do of the fossilized dwellers of the ancient Cambrian Seas. The representatives herein reported of the eight major orders of Crustacea obtained by the "*Eagle*" and "*Ara*" present an incomplete synoptic series of the diversification existing in crustaceous organisms. The North American species of only two of these eight orders have been exhaustively reported, the Cirripedia, by Dr. Henry A. Pilsbry, and the parasitic division of the Copepoda, by Dr. Charles B. Wilson. Few life histories are imperfectly known among the hundreds of described species of American Crustacea. These fragments of knowledge indicate an indescribably rich field for students of evolution. The Macrura possess the most complete metamorphosis found in the Decapoda. The ability of certain *Penaeidae* to develop segments in the larva from before backwards exhibits a very primitive character not known in other Decapoda but showing clearly the affinities of the higher with the lower forms of Crustacea. Certain of the *Eryonidae* are living examples of the blind, claw-footed dwellers of the Triassic Seas. The vital place of Crustacea in the

ecology of the sea is acknowledged, yet little work has been done in America on this subject. There is great need for a thorough monographic report of American Crustacea.

ACKNOWLEDGMENTS.

As during the preparation of the preceding volume, Mr. Vanderbilt has generously placed unexcelled facilities at my disposal throughout the present investigation. I have also enjoyed full privileges of research in the American Museum of Natural History and am especially indebted to Dr. R. W. Miner, curator of the Department of Lower Invertebrates, and to Miss Hazel Gay and Miss Margaret Titcomb of the Library. The colleagues and institutions whose friendly coöperation contributed to the success of the first volume have continued their kindness during this report. The line drawings of the present volume were made by Mrs. Helen Ziska, who also retouched photographic illustrations which were made, also under my direction, by Mr. Julius Kirschner of the photographic laboratory of the American Museum of Natural History. The color plates referred to were prepared by Mr. W. E. Belanske, under Mr. Vanderbilt's direction.

GEOGRAPHICAL DISTRIBUTION OF THE SPECIES.

WEST INDIAN FAUNA.

Anomura.

Petrochirus bahamensis (Herbst).

Two large specimens, from the Florida Reefs, 1923.

Parapagurus pilosimanus abyssorum Henderson.

Two males, dredged in 1100 fms., off Miami, Fla., March 3, 1926, inhabiting the shell, *Natica* species indet., encased by the anemone, *Epizoanthus paguriphilus* Verrill. Rare.

Coenobita clypeatus (Herbst).

Two specimens, from the shores of Corrientes Bay, Cuba, February 22, 1924. One specimen from the Florida Reefs, 1923.

Munida stimpsoni A. Milne Edwards.

One, young, Porto Padre, Cuba, 2 fms.

Munidopsis simplex A. Milne Edwards.

Eighteen specimens, dredged in 1100 fms., off Miami, Fla., March 31, 1926. Very rare.

Ptychogaster spinifera A. Milne Edwards.

One specimen, dredged 7 miles S. W. of Alligator Reef, Fla., 150 fms., March 30, 1926. Very rare.

Lepidopa venusta Stimpson.

Nine specimens, including both sexes, Miami Beach, Florida, March, 1924. Very rare. This is the largest single series ever taken and also establishes the first Florida record for the species.

Emerita emerita (Linné).

Ten specimens, Miami Beach, Florida, March, 1924.

Pisosoma angustifrons Benedict.

Five specimens, dredged in 20 fms., S. of Sand Key, Key West, Fla., January 25, 1924. Very rare; the northern range of the species is substantially extended by the above material.

Petrolisthes armatus (Gibbes).

One specimen, Cape Cruz, Cuba, 3 fms., February 11, 1924.

Petrolisthes armata (Gibbes).

One specimen, Cualeo Reales, Cuba. One, Pigeon Key, Fla., April 17, 1923.

Porcellana rosamondae Boone, new species.

One specimen, Limon Bay, Panama, January, 1928. Holotype.

Macrura.

Scyllarides aequinoctalis Lund.

One large specimen, Bay Biscayne, Florida, 1923, field tag 208.

Scyllarus americanus S. I. Smith.

Two specimens, dragnet, off Knight's Key, Fla., March 29, 1926; one from Marquesas Keys, Fla., March 2, 1924. Very rare.

Panulirus laevicauda Latreille.

One specimen, Bay Biscayne, near Miami, Florida, January, 1923. Very rare in the northern West Indies.

Panulirus argus Latreille.

Two specimens, one very large, Bay Biscayne, Florida, March, 1923. One young specimen, Miami, Florida, 1924.

Panulirus guttatus (Latreille).

One very large specimen, Miami, Florida, 1923.

Stenopus hispidus (Olivier).

One very large specimen, Bay Biscayne, Florida, off Miami, Fla., 1923; three specimens from the Florida Reefs, 1923, by the "*Ara.*"

Stenopus scutellatus Rankin.

Two specimens, 10 fms., Little Stirrup Cay, Bahamas, February 28, 1925. Very rare.

Peneus brasiliensis Latreille.

Two specimens, south coast of Cuba, field tag "G," February, 1925.

One specimen, Turtle Harbor, Florida, January 10, 1923. One, Port Antonio, Jamaica, 2 fms., February, 1926. One, Guantanamo Bay, Cuba, February 17, 1928. Three, West Indies. One, Turtle Harbor, Fla., April 10, 1923. See also Mediterranean record for this species.

Peneus setiferus (Linné).

One specimen, Marquesas Keys, Florida, 30 fms., March 2, 1924.

Penaeopsis goodei (S. I. Smith).

One specimen, American Shoal Light, Florida, 50 fms., March 3, 1924. Three specimens, taken with dip-net at electric light, Hawks' Nest, Cat Island, Bahamas, January 15, 1928. One specimen, San Salvador, B. W. I., February, 13, 1926. Two specimens, Bimini, Bahamas, January, 1923.

Eusicyonia edwardsii (E. J. Miers).

One specimen, Limon Bay, Panama, 1926.

Eusicyonia dorsalis (Kingsley).

One specimen, from Port Tanamo, N. coast of Cuba, February 23, 1925.

Acanthepyra purpurea A. Milne Edwards.

One specimen, taken off Cape Malo, Panama, dredge down 300 fms., March, 1928. Color plate of this species made.

Systellaspis debilis (A. Milne Edwards).

Two females, dredge in 150 fms., seven miles off Alligator Reef, Fla., March 20, 1926.

Leander tenuicornis (Say).

Two specimens, taken in "*Sargasso,*" on the south coast of Cuba, February, 1923. One, Turtle Harbor, Fla., 2½ fms., April 28, 1926. Three, Hogsty Key, San Salvador, B. W. I.

Macrobrachium acanthurus (Wiegmann).

Three specimens, Havana, Cuba, March 27, 1926. Very rare.

Tozeuma carolinense (Kingsley).

Seven specimens, two of which are ovigerous, from Double Headed Shot Cay, Cay Sal Bank, Bahamas, February 19, 1925, grassy bottom. Rare.

Alpheus vanderbilti new species.

Type. One specimen, taken in 20 fms., south of Sand Key, Key West, Fla., January 29, 1924.

Alpheus formosus Gibbes.

One specimen, Pigeon Key, Fla., February 17, 1923.

Alpheus armillatus H. Milne Edwards.

One specimen, two fms., Port Antonio, Jamaica, February 17, 1926.

Alpheus heterochaelis Say.

One specimen, Pigeon Key, Fla. One, off Sand's Key, Key West, Fla.

Synalpheus fritzmulleri Coutiere.

Pigeon Key, Fla., one.

Synalpheus brevicarpus (Herrick).

One, Carenge Bay, Le Mole, Haiti, February 4, 1924. Two, Limon Bay, Panama, 1928. One, Knight's Key, Florida, March 5, 1923.

Synalpheus minus (Say).

One female, Loggerhead sponge, Knight's Key, Fla., 2 fms., March 6, 1925.

Synalpheus longicarpus (Herrick).

Five, from sponge, Carenge Bay, Le Mole, Haiti, February 4, 1924.

Glyphocrangon aculeata A. Milne Edwards.

13 specimens, 1100 fms., off Miami, Fla., March 3, 1926. These establish the northernmost record and greatest depth of this unusual deep-sea species.

Isopoda.

Cirolana mayana Ives.

Several specimens, Hawks' Nest, Cat Island, Bahamas, cruise 1928.

Anilocra laticauda H. Milne Edwards.

One specimen, Bury Island, Bahamas, January 21, 1923; one large, ovigerous female, dredge 11 fms., Casa Blanca, Cuba, August 22, 1924. Eleven young, free-swimming stages, Hogsty Key, San Salvador, B. W. I., February 13, 1926.

Cymothoa excisa Perty.

One specimen, from fish, Pilon, Cuba, March, 1928.

Cirripedia.

Poecilasma inaequilaterale Pilsbry.

Seven specimens, on *Cancer borealis,* dredged in 1100 fms., off Miami, Fla. Rare.

Copepoda.

Caligus aliuncus Wilson.

Seven, from the outer skin of a dolphin, caught February 19, 1926, no locality, but the yacht was in the West Indian region at that date. Rare.

Pandarus bicolor Leach.

Seven, on tiger shark, West Indies, March 23, 1925. (Also Pacific coast.)

MEDITERRANEAN FAUNA.

Anomura.

Pagurus calidus Risso.

Ten specimens, dredged in 65 fms., 11 miles N. W. of Lissa Island, Dalmatia, Adriatic Sea, September 13, 1924.

Pagurus prideauxii Leach.

One specimen, inhabiting sponge, *Suberites domuncula,* dredged in 100 fms., 9½ miles E. by ½ S. from Cape Bon Tunis, North Africa, July 19, 1927.

Macrura.

Sergestes vigilax Stimpson.

Two specimens, dredged 38 miles E. ½ S. E. of Cape Spartivento, Sardinia, in 325 fms., July 22, 1927.

Sergestes grandis Sund.

One, St. Raphael Station, Mediterranean, 400 fms., March 23, 1927.

Sergestes robustus S. I. Smith.

One specimen, dredge down 400 fms., St. Raphael, bearing S. S. E., distance 9 miles, south of France, Mediterranean Sea, March 23, 1927.

Gennadas elegans S. I. Smith.

One specimen from the same station as *S. robustus.*

Peneus brasiliensis Latreille.

One specimen, dredged in 35 fms., 5 miles N. E. by N. of Cape Carthage, Gulf of Tunis, Mediterranean Sea, January 21, 1927.

Parapeneus longirostris H. Lucas.

Two, dredged in 100 fms., 9½ miles E. by S., ½ S. from Cape Bon Tunis, North Africa, Mediterranean Sea, July 19, 1927.

Leander squilla (Linné).

One, 11 fms., Casa Blanca, Morocco, August 20, 1924.

Schizopoda.

Eucopia unguiculata Willemoes-Suhm.

One specimen, 400 fms., off St. Raphael, bearing S. S. E., distance 9 miles, Mediterranean Sea, south of France, March 23, 1927.

Nematoscelis megalops G. O. Sars.

Twelve specimens, two ovigerous, 900 fms., 10 miles S. by E. of Monaco, Mediterranean Sea, April 19, 1927.

Isopoda.

Idothea metallica Bosc.

Two specimens, S. by E. of Monaco, Mediterranean Sea, 900 fms., April 19, 1927.

Amphipoda.

Phronime sedentaria (Forskal).

Two, in dredge, 10 miles S. by E. of Monaco Harbor, Mediterranean Sea, 900 fms., April 19, 1927. One specimen, Marcus Pinedo, Monaco, May, 1925. One, from 325 fms., 38 miles S. E. ½ E. of Cape Spartivento, Sardinia, July 22, 1927. See also Pacific record for this species.

LABRADOR-NEW ENGLAND FAUNA.

Anomura.

Pagurus bernhardus (Linné), s. s., Brandt.

One specimen, in shell, on top of which there is an anemone, *Actinauge rugosa* Verrill, dredged in 180 fms., Bay of Islands, Newfoundland, September 3, 1926.

Pagurus longicarpus Say.

Eight specimens, in shell, *Littorina littorea* Linné, shores of Northport Harbor, Long Island, N. Y., Sept. 11, 1928.

Lithodes maia (Linné).

One specimen, dredged in 200 fms., 9 miles S. W. by W. of Port Basque, Newfoundland, September 1, 1926. A very rare deep-sea form.

Macrura.

Homarus americanus H. Milne Edwards.

One very large and one young specimen from the coast of Maine. One very large specimen from Eastport, Maine.

Hippolyta projecta Bate.

One specimen, taken 7 miles off Port Basque, Newfoundland, 200 fms., September, 1926. Very rare.

Spirontocaris tenuis (Bate).

Five specimens, dredged in 200 fms., September, 1926, nine miles S. W. by W., Port Basque, Newfoundland, September, 1926.

Spirontocaris groenlandica (Fabricius).

Five specimens, dredged in 7 fms., mud bottom, upper end of Whitehaven Harbor, Nova Scotia, September 1, 1926.

Crangon septemspinosa Say.

Three specimens, Beaver Harbor, Nova Scotia, September 10, 1926.

Pontophilus norvegicus M. Sars.

One specimen, dredged in 200 fms., 9 miles S. W. by W. of Port Basque, Newfoundland, September, 1926.

Argis lar (Kroyer).

Three specimens, Beaver Harbor, Nova Scotia, September 10, 1926.

Seven, upper end of Whitehaven Harbor, Nova Scotia, September 6, 1926, 7 fms.

Sabinea septemspinosa Sabine.

Several specimens, dredged in 40 fms., middle of St. George's Bay, Newfoundland, September 2, 1926.

Schizopoda.

Meganyctiphanes norvegica (Sars).

Several specimens, 9 miles S. W. by W. of Port Basque, Newfoundland.

Amphipoda.

Caprella geometrica Say.

Fourteen specimens, Eastport, Maine, August 23, 1923.

Ericthonius rubricornis (Stimpson).

One specimen, Eastport, Maine, August 23, 1923.

TROPICAL AMERICAN PACIFIC FAUNA.

Anomura.

Paguristes fecundus Faxon.

Five specimens, dredged in 100 fms., Pacific Ocean, off Punta Arenas, Costa Rica, February, 1928. Very rare.

Calcinus explorator Boone.

One specimen, from tide-pool, Eden Island, Galapagos Island, March 12, 1928. Four, Hood Island, Galapagos, in shells of *Cerithium maculosum* K., February 5, 1928, collected by the *"Ara."* Rare; second record of the species.

Pagurus albus (Benedict).

One specimen, Punta Arenas, Costa Rica, March, 1928. One, Canos Island, Costa Rica, February, 1928. Rare; first Costa Rican record of the species, also here illustrated for the first time.

Munida gregaria (Fabricius).

Two specimens, dredged in 100 fms., Punta Arenas, Costa Rica, February, 1928.

Emerita analoga Stimpson.

One ovigerous female, Punta Arenas, Costa Rica, March, 1928. Rare. One, Perlas Islands, March, 1928.

Peneus brevirostris Kingsley.

One specimen, Conway Bay, Indefatigable Island, Galapagos Islands, March 1, 1926.

Penaeopsis kishinouyei (Rathbun).

One male, drag-net, Punta Arenas, Costa Rica, February 14, 1928. Rare.

Eusicyonia penicillata (Lockington).

One specimen, dredged in 100 fms., off Punta Arenas, Costa Rica, February, 1928. Rare; this is the first record of the species so far south.

Gennadas clavicarpus de Man.

Seven specimens, 7 miles S. W. of Cape Malo, Panama, 300 fms., March, 1926.

Sergestes phorcus Faxon.

One specimen, taken with the dredge down 300 fms., bottom depth 1400 fms., Pacific Ocean, 7 miles off Cape Malo, Panama, March 30, 1926. Rare.

Macrobrachium olfersii (Wiegmann).

One specimen, from a fresh water stream emptying into Chatham Bay, Cocos Island, Pacific Ocean, March 5, 1926.

Macrobrachium jamaicense (Herbst).

Two specimens, from fresh water stream emptying into Chatham Bay, Cocos Island, Pacific Ocean, March 5, 1926.

Conchodytes margarita (S. I. Smith).

Five specimens, Punta Arenas, Costa Rica, February, 1928. Very rare.

Alpheus bouvieri chilensis Coutiere.

One specimen, tide-pool, Webb Cove, Albemarle Island, Galapagos Islands, February 3, 1928.

Schizopoda.

Nematoscelis megalops G. O. Sars.

One specimen, 300 fms., S. W. of Cape Malo, Panama, March, 1928.

Isopoda.

Rocinela aries Schiodte and Meinert.

One, Jicaron Island, Panama, on a snapper, January 27, 1928. Rare.

Nerocila bartschi (Boone).

Taboga Island, Perlas Islands, Panama, February 19, 1928. Very rare.

Cymothoa exigua Schiodte and Meinert.

One, parasitic in mouth of angel fish, James Bay, San Sebastian Island, Galapagos Islands, March 3, 1926. Very rare.

Amphipoda.

Phronime sedentaria (Forskal).

Two specimens, taken 50 miles S. W. of Cape Malo, Panama, Pacific Ocean, dredge down 300 fms., bottom depth 1400 fms., March, 1928. See also Mediterranean faunal sheet.

Petrochirus bahamensis (Herbst), reduced one-third.

Copepoda.

Pontella plumata (Dana).

About a dozen females, dredge down 300 fms., seven miles S. W. of Cape Malo, Panama, March, 1928.

Pandarus bicolor Leach.

About 36 specimens, parasitic on shark, taken off Jicaron Island, Panama, January 27, 1928; seven specimens from tiger shark, captured in West Indian seas, March 23, 1925.

SYSTEMATIC DISCUSSION.

ANOMURA.

Family: **PAGURIDAE.**

Subfamily: **Pagurinae.**

Genus: **PETROCHIRUS** Stimpson.

Petrochirus bahamensis (Herbst).

Plate 1.

DIAGNOSTIC CHARACTERS: The largest of the marine hermits of the West Indian faunal region. Chelipeds subequal or sometimes moderately unequal, covered with an arrangement of granules, consisting of three in each group.

TYPE: Herbst's type was taken in the Bahama Islands, inhabiting the shell of "*Buccino magno variegato* Lifter 359, No. 12," and was deposited in the Berlin Museum.

DISTRIBUTION: Southern Florida to Brazil. Littoral.

MATERIAL EXAMINED: Two very large specimens taken in dredge, Florida Reefs, 1923, by the "*Ara,*" William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Precervical region of carapace shield-shape, widest anteriorly, the dorsal surface slightly convex, with several scattered, coarse pits and clusters of setae; the frontal margin bears a blunt, median triangular tooth, which is no farther advanced than the similar submedian pair which occur between the bases of the eye-stalk and the external antennae; outside of the submedian point the frontal margin is excavate at the base of the antennal peduncle, terminating at the lateral margin in a blunt tooth. The postcervical region of the carapace widens posteriorly with the postlateral regions lobed; the encasing membrane is very tough, leathery, including the median region; a series of six to eight longitudinal lines or wrinkles

mark the upper surface; tufts of long setae are set regularly along these lines and on the lateral walls, especially anteriorly, where the tufts are thicker and longer.

The abdomen is coiled, soft, encased in a tough membrane, which bears on its upper surface faint transverse indications of the fused sutures; the lateral regions bear many tufts of long setae; the underside is transversely ribbed with folds of thickened skin; the pretelsonic segment is small, calcareous, the telson has the proximal part about as long as the pretelsonic segment, both bear an approximately median longitudinal groove; the distal part of the telson is unequal-sided, heartshaped, the apex being pointed and on the left side, while the right margin is slightly excavate. The rhipidura have a large, flexible basal joint; the inner blade large, its anterior margin convex, its posterior lateral margin concave, the tip rounded, margins setose, the upper surface covered with movable setae; the posterior blade is very small, but similar to the larger one.

The ocular scale is rounded, wide at the base and tapers to an acute, narrowly triangular tip which is directed obliquely inward. The eyestalks are jointed, very flexible, elongate, slightly bulbous basally, evenly cylindrical through the greater part of their length, dilating slightly just below the cornea, which is also dilated, terminal, with a rounded, tongue-like projection of the stalk on the upper surface of the cornea, tipped with a tuft of long setae. The eyestalks are about 2 mm. shorter than the precervical region of the carapace, or reach as far forward as the distal margin of the meral joint of the chelipeds.

The antennulae have the proximal joints stocky, situated beneath the eyestalk; the second joint is slender, reaching to midway the eyestalk; the third joint is about one-third longer than the second joint; the flagellum is biarticulate, the longer branch being scarcely half the length of the third peduncular joint.

The antennae have the flagellum extending a half inch beyond the tip of the great cheliped; the basal article is about as wide as long, with the outer distal angle forming an acute tooth; the acicule is narrow, elongate, twice as long as the first article is in the median line, has the inner lateral margin denticulate, the tip very acuminate, reaching to almost midway the length of the last pedunculate article; the second article is short, the third article is one-half as long as the eyestalk, slender, laterally compressed; the flagellum is multiarticulate, slender, extending beyond the tip of the chelipeds.

The chelipeds are moderately unequal, the right being the larger; the basis and ischium are stout, well developed; the merus is short, three-sided, wider distally, armed with numerous large, spinose granulae on the lateral and proximal margins; the carpus is as large and almost as long as the merus, with the entire upper and outer surface paved with large spinose or dentate granulations; on the inner lateral margin these granulations form a row of five or six acute spines, while farther back on the upper surface the granulations form fan-like clusters of three or four, some of which are spinose on the tip, and all of which are fringed anteriorly by a band of fine short red setae. The propodus is massive, the upper and outer surface moderately convex, entirely paved with granules similar to those on the carpus but more crowded, entirely covering the surface; those along the inner lateral margins are produced into a series of more conical spines. The thickness of the propodus along its inner face is equivalent to two-thirds its width on the upper surface, which is approximately equal to the length of the palm; the propodal finger is equal in length to the palm and is similarly ornamented; its cutting edge is armed with a series of close-set, blunt teeth, which increase in size distally; the hinged finger swings slightly obliquely and is similar and subequal to the propodal finger. The left cheliped is very slightly smaller than the right but otherwise similar.

The first ambulatory legs are similar and equal, except that the dactyl of the right leg is one-eighth inch longer than that of the left; the merus is triquetral, with a few small, spinose granules placed transversely on the distal part of the upper surface; the carpus is two-thirds as long as the merus and has a row of seven or eight very acute spines along the upper lateral margin; the outer surface is sparsely covered with granulations, like those of the cheliped; the propodus is subequal in length to the carpus and has about eight acute spines along its inner lateral margin and the remaining outer surface granular like the carpus; the dactyl is one and one-half times as long as the propodus and is curved, tapering, with an acuminate, horn-colored tip; the lateral margins are fringed with thick, long setae, and a similar line of thick shorter setae extends down the median upper surface, which is practically carinated by a line of denticle-like spinose granulations.

The second ambulatory legs are markedly unequal, the right one being slightly longer than the adjacent first ambulatory, while the second left leg only reaches to the base of the long dactyl of the adja-

cent first ambulatory. It has the merus thickened, subequal in length to the carpus, with numerous setae and a few rugae on the upper surface; the carpus is laterally compressed, stocky, with a row of seven or eight spines on the upper margin, the remaining surface granulose; the dactyl is twice as long as the propodus and is three-sided, a midrib of spinules accentuated by a fringe of long, thick setae, golden red in color; there is a similar line of setae on both lateral margins and other scattered setae and small tubercles on the surfaces between; the tip is acute, horn-like.

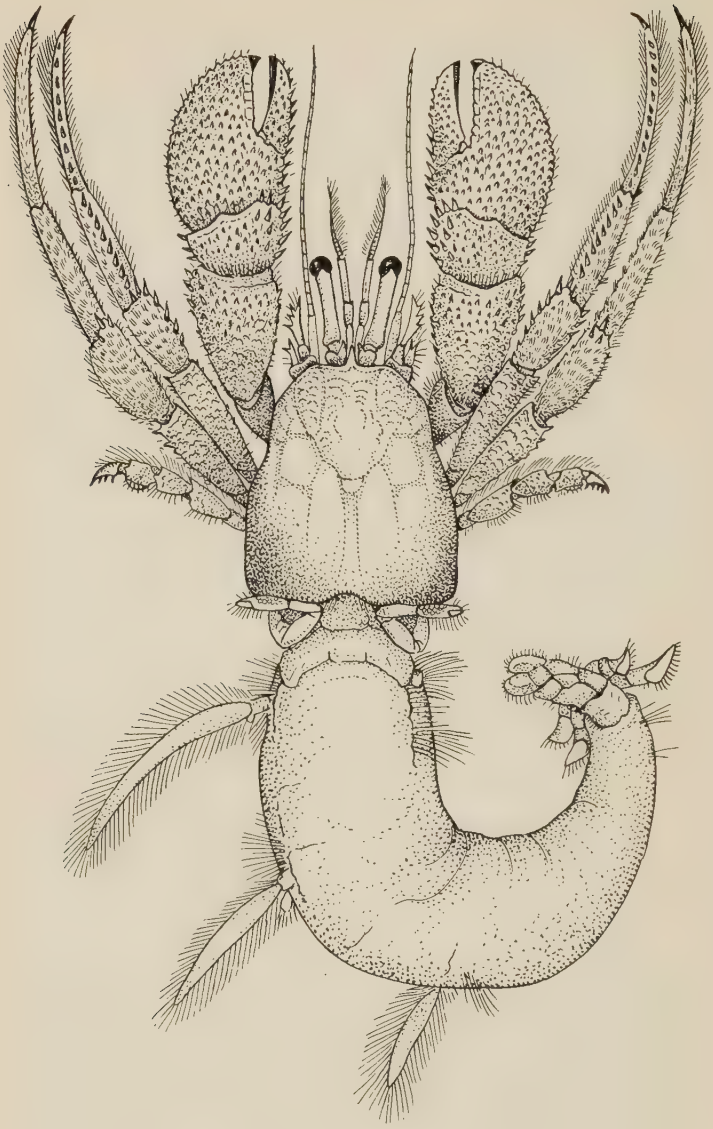
The fourth pair of legs are characteristically short, subequal, the merus the longest joint of the series; the carpus three-fourths as long as the merus, widest distally; the propodus is squarish proximally, with the hinder distal angle produced into a thick, blunt tooth, which is appressed close to the dactyl and extends almost to its tip and bears on the upper side an elongate oval patch of close-set, movable, horny scales; the dactyl is about as long as the proximal part of the propodus and is curved, tapering distally, the apex horn-tipped and a series of horny spinules on the postlateral margin. The entire anterior lateral margin of the fourth leg bears a series of tufts of long setae.

The fifth legs are small, arched around under the side of the body; the propodus long, it and the dactyl forming a weak claw; there is an elongate-ovate patch of movable scales on the distal part of the propodus and continuous on the upper surface of the dactyl. The propodus and dactyl are richly furnished with tufts of long setae, especially on the distal end.

SYNONYMY.—*Cancer bahamensis* HERBST, Naturg. Krabben u. Krebse, vol. 2, sect. 3, p. 30, 1796.

Petrochirus bahamensis MARY RATHBUN, Ann. Inst. Jamaica, vol. 1, art. 1, p. 42, 1897.—BENEDICT, Bull. U. S. Fish. Comm., vol. 20, part 2, p. 140, 1901.—HAY and SHORE, *idem,* vol. 35, p. 410, 1918. SCHMITT, Bijdragen tot de Dierkunde Natura Artis Magister te Amsterdam, Afl. 23E, 1924, p. 80.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 76, 1927.

Pagurus granulatus OLIV., Encycl. Méth., vol. 8, p. 640, 1811.—LAMARCK, Hist. Anim. sans Vert., vol. 5, p. 220, 1818.—DESMAREST, Dict. Sci. Nat., vol. 28, p. 288, 1823.—H. MILNE EDWARDS, Ann. Sci. Nat. Zoöl. (2), vol. 6, p. 275, 1836, and *idem* (3), vol. 10, 1848, p. 61; Hist. Nat. Crust., vol, 2., p. 225, 1834.—DANA, U. S. Explor. Exped. Crust., part 1, p. 453, 1852.—VON MARTENS,



Paguristes fecundus Faxon, ×1.66.

Archiv. fur Naturg., vol. 8, p. 120, 1872.—Henderson, Rept. Sci. Results Explor. Voyage *"Challenger"* Zoöl., Crust. Anomura, vol. 27, p. 56, 1888.

Petrochirus granulatus Stimpson, Proc. Phila. Acad. Nat. Sci., 1858 (1859), p. 233.—Heller Novara Crust., p. 85, 1853.—Ortmann, Zoöl. Jahrb. Syst., vol. 6, p. 289, 1892.—Dolfein, S. B. Bayer. Ak. Munchen, 1899, p. 78.—Alcock, Catal. Indian Decapod Crust., part 2, Anomura, fasc. I, Pagurides, 1905, p. 170, Calcutta.

Genus: **PAGURISTES** Dana.

Paguristes fecundus Faxon.

Plate 2.

Diagnostic characters: As pointed out by Dr. Faxon, the nearest relatives of this species are the West Indian *P. lymani* and the New Zealand species, *P. subpilosus* Henderson. The telson of *P. fecundus* has the margin ornamented with obscure teeth, while in *P. lymani* it is set with numerous spines which have dark-colored horny tips. *P. fecundus* also has a more prominent and acute rostrum which overhangs the ocular segment and fewer spines on the antennular acicule than does *lymani.*

Type: Two ovigerous females taken at *"Albatross"* station 3368, off Mariato Point, in 66 fathoms, in shells of *Mitra* and *Phos.*

Distribution: Known from the type material only and *"Ara"* expedition.

Material examined: Five specimens, both sexes, dredged in 100 fathoms, Pacific Ocean, off Punta Arenas, Costa Rica, February, 1928, by the *"Ara."*

Technical description: Carapace flattish, precervical region small, heart-shaped frontal margin, with an acute, triangulate, rostral point which projects between the ocular scales; on either side of the rostral point the frontal margin is concave at the base of the eyestalk and carinate, then produced to a weak, lateral point and thence sloping obliquely back to the lateral margin; the lateral margin is rounded anteriorly and armed with a row of five or six spines, some of which are double, along the edge; posteriorly the lateral margins converge to a rounded point; the postcervical margin is widest posteriorly, being twice as wide as the frontal margin, the lateral lobes with their lateral margins broadly rounded, the upper surface flattish; the posterior margin is but very little excavate above the abdomen; the latter is asymmetrical, dorso-ventrally flattish, loosely coiled, the pre-

telsonic segment with a squarish, calcareous plate on the upper surface, its posterior angles slightly peaked; the proximal part of the telson is as wide but shorter than the preceding plate, with a median longitudinal depression and with the distal margin slightly excavate, the angles peaked; the distal part of the telson is squarish, about as long as the two preceding plates considered together with the subparallel lateral margins incised medially and the distal margin a rounded lobe on either side of a small median incision and with three or four spinose denticulations on each half, also a fringe of close-set setae. The uropoda have the peduncle strong, convex and nodulose on the upper surface; the branches decidedly unequal, auriculate, the smaller outer one almost entirely covered by corneous scales; the larger one with a crescentic patch of scales along the anterior half of its outer surface. The right uropod is much smaller than the left and its blades are less unequal in size to each other. There are three biramose appendages on the abdomen, each of which has the peduncle short; the anterior distal blade is long and narrow, oval, heavily fringed with cilia; the posterior blade is obsolete, represented by a small nodule about 1 mm. long, which is obscured by the cilia.

The ocular scale is small, wide basally and with the inner half produced to a convex-sided acuminate point. The eyestalks are about as long as the precervical part of the carapace in the median line, cylindrical, increasing slightly in diameter distally, with a slight rounded point projecting onto the cornea on the upper surface; the cornea is terminal, spherical, shining black.

The antennulae have the basal joint short, the second and third articles subequal, clavate, extending to the base of the cornea; the flagellum is thick, the upper branch one and one-third times as long as the third penducular article, tapering, with a thick brush of setae on the under side; the inferior branch is slender, three-fifths as long as the upper branch.

The antennae are short, the tip of the flagellum not quite reaching to the base of the finger of the cheliped. The first peduncular article is short and wide, squarish basally with a slender, distally forked tooth arising at the outer distal angle, and the acicule from the inner is short, tapering, its apex directed inward; there are two acute spines proximally near the inner lateral margin and two on the outer lateral margin subdistally in addition to the acute apex. The inferior inner distal angle of the first peduncular joint is produced beneath the second article and is acuminate distally; the second article is very short,

inconspicuous; the third article is slender, two-thirds as long as the acicule, cylindrical, reaching slightly farther forward; the flagellum is composed of about 39 tapering articles.

The chelipeds are very slightly unequal, the right being a trifle the larger in the young specimens, but the older, larger specimens have these approximately equal. They are very much dorso-ventrally flattened or ironed out, with the merus extending as far forward as the base of the cornea and slightly triquetral, the upper and outer surfaces almost at angles to one another, both roughly granulose; the carpus is short and wider than long, with the inner lateral margin longer than the outer, convex and armed with three or four spines; the propodus and dactyli form a broad oval, which is wider through the palm, the fingers tapering slightly; the upper surface very slightly convex and entirely paved with coarse granules which have a spinulose apex; along the convex lateral margins these become a series of real, corneous spinules. The propodal finger is about as long as the palm, forming a broad triangle, the apex acute, the cutting edge with about ten broad, molariform teeth; the hinged finger is similar to the propodal but not so wide and fits closely upon it.

The first and second ambulatories are similar, the second pair slightly exceeding the first in length, both sides are subequal; both ambulatories exceed the length of the cheliped by the length of the ambulatory dactyl; the proximal joints are well developed; the merus is short, scarcely longer than the carpus; the propodus is one and one-fourth times as long as the carpus; these three joints are rough, with spinulose granules and setae on the upper surface; the dactyl is the longest joint of the leg, being as long as the carpus and propodus taken together, very curved and tapering, with an acuminate horn tip armed with spinules on the upper surface and stiff setae along the lateral margin.

The fourth legs are short, stocky, with the propodus rectangular, almost squarish; the dactyl about as long as the propodus and set at its end, tapering, acuminate, with the concave postlateral margin set with a row of coarse spinules.

The fifth legs are small, reflexed, very weakly subchelate; the propodus being elongate with many scales, the dactyli very short and weak and concealed in a brush of setae.

SYNONYMY.—*Paguristes fecundus* FAXON, Bull. Mus. Comp. Zoöl., vol. 24, p. 173, 1893; Mem. Mus. Comp. Zoöl., vol. 18, p. 66, 1895.

Genus: **CALCINUS** Dana.

Calcinus explorator Boone.

Plate 3.

DIAGNOSTIC CHARACTERS: Propodus and dactyli of great cheliped almost subcircular, palm wider distally than its length in the median line; meral and carpal joints of the second and third right ambulatories equal to or only a little longer than those of the left legs.

TYPE: The type, an adult male specimen, was taken at *"Arcturus"* Station 54, Hood Island, Galapagos, in 15 fms., by Dr. William Beebe, while diving, and is deposited, together with forty-odd additional specimens, in the collections of the Tropical Research Station, New York Zoölogical Society.

DISTRIBUTION: Restricted to the Galapagos; littoral.

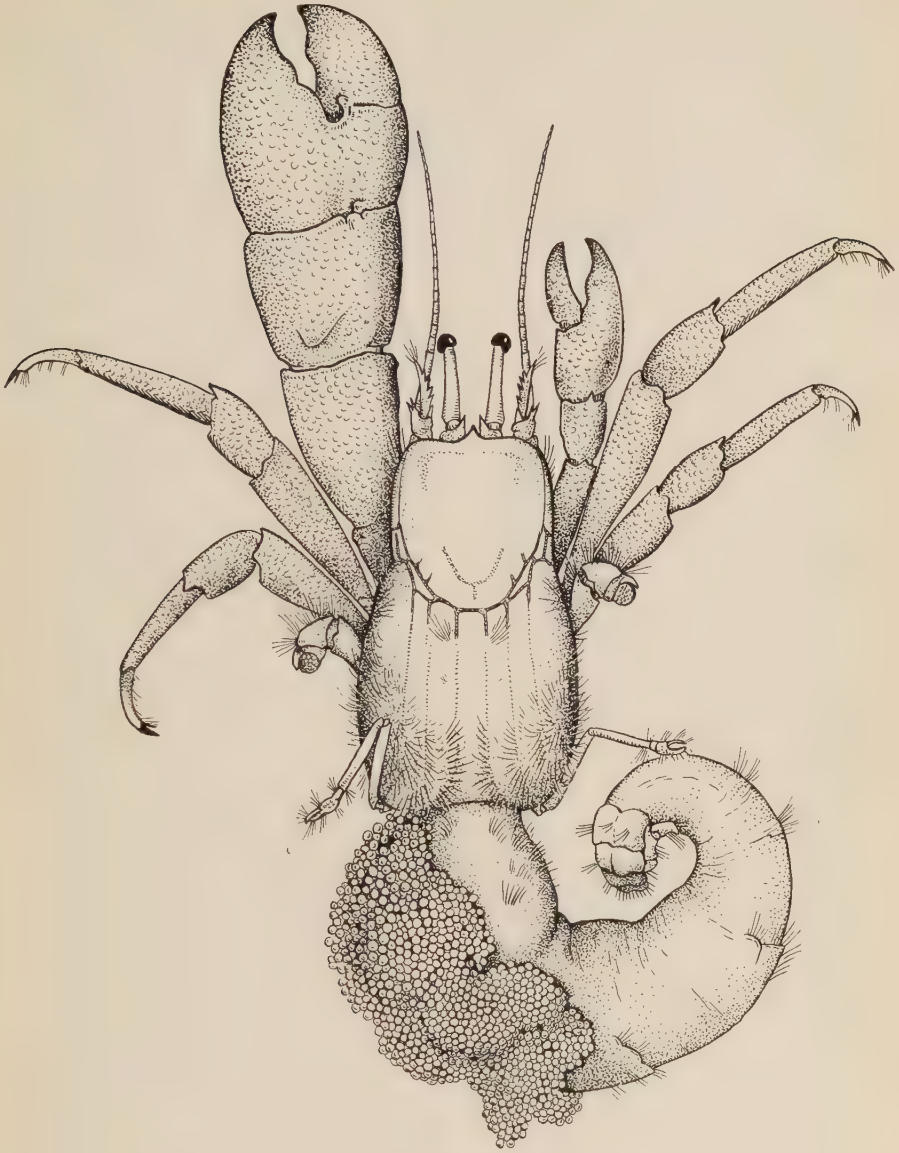
MATERIAL EXAMINED: One specimen taken by the *"Ara"* in tide-pool, Eden Island, near Indefatigable Island, Galapagos, March 12, 1928. Four, Hood Island, Galapagos, in shells of *Cerithium maculosum* K., February 5, 1928.

COLOR: See type description.

TECHNICAL DESCRIPTION: Carapace with the frontal margin almost straight; rostral point very small, lateral projections even more obscure. Precervical region of carapace with hard dorsal plate squarish, having margins subparallel, except posteriorly, where they converge slightly, forming a rounded posterior margin. Lateral walls and posterior region subglobose—membranous.

Ocular peduncles about as long as the anterior border of the carapace, cornea terminal, hemispherical, ocular scale about as long as the inner side of the basal antennal joint, sublobate, tapering to an acute point, separated from each other by a V-shaped space.

Outer antennae with basal joint about two-thirds as broad as ocular peduncle and having the outer dorsal distal angle produced acutely and finely serrate on the margin of the produced joint; the second joint is small, ventrally placed, triangulate; the third joint is compressed, cylindrical, almost concealed dorsally by the acicule, which arises from the first peduncular segment, tapering conically to an apex, being about as long as the third peduncular article and having the inner dorsal margin quadriserrate. The fourth peduncular article is about as long as the dorsal view of the first three articles taken together, slenderer, cylindrical, somewhat flattened dorsoventrally and



Calcinus explorator Boone, ×5.

supporting flagellum consisting of many fine rings and extending as far forward as the base of the movable finger of the great chela.

The peduncles of the inner antennae are about as long as the eyestalks; the flagellum is triarticulate, each joint successively increasing in length distally; it is two-branched, the longer, stouter branch being about as long as the third peduncular article, tapering conically and consisting of about 25 rings and bearing a long, fine brush of setae on the ventral side. The shorter, lower branch is about half as long as the upper branch and consists of 10 or 11 annulations which are about the same diameter as the distal annulations of the upper flagellum.

The left cheliped is much larger than the right and has the basis and ischium quite small, only the outer distal angle of the latter being visible in a dorsal view; the merus is trigonal, the dorsal surface broad and curved; the carpus is a trifle shorter than the merus, narrower basally, outwardly convex and broadening distally to form a close union with the propodus; the inner distal angle of the carpus is produced into a tiny interlocking point and the outer distal angle of the carpus is produced into a similar interlocking point and its lateral contour slightly ridged. The propodus is subovate, almost subcircular; its diameter, taken at the base of the movable finger, is slightly greater than the long diameter, taken from the inner basal angle of the finger to the carpal margin. The fixed finger is wider basally than long, the line from the tip of the fixed finger to the outer basal angle of the movable finger obtusely truncates the hand, being practically an unbroken line, save for the minute median depression into which the basal tooth of the movable finger fits. This line and the placing of the fingers is distinctly different from *Calcinus chilensis* Milne Edwards, which Stimpson says his species, *Calcinus obscurus,* is like, "except for the absence of tubercles on the chela." The movable finger of the present species has the outer margin curved, the apex occurring at the outer lateral margin, the inner margin fitting closely upon that of the fixed finger. The fingers open obtusely; their distal ends are neatly spoon-shaped and the meeting surfaces of the fixed finger crenulated, indicating 14 teeth along the outer margin of the meeting surfaces; the inner margin of this surface of the finger is set with five clusters of brush-like setae, the largest and innermost one being opposite the basal great molar, the remaining four being subequal, the distal two being almost beside each other. The movable finger is similarly crenulated, indicating seven teeth of moderate size

and three much larger ones adjacent to the base; inside these teeth are placed a patch of setae at the base of the hinge, followed by a row consisting of seven subequal and subequally spaced tufts of setae.

The right chela is much smaller than the left; has the meral and carpal joints less swollen, narrowed, and the hand and fingers a miniature replica in contour of those of the left chela, but the fingers are more broadly spoon-shaped. The first and second ambulatories are subequal, those of the right side having the meral and carpal joints equal in young or only a very little longer in large adults than those of the left side—this being another item in which the present species differs from *C. chilensis* Milne Edwards and *C. obscurus* Stimpson, in which the above discussed joints of the right legs are described as being much longer.

The fourth ambulatory legs are short, flattened, curved to fit the body contour and have the upper and lower margins of all joints densely fringed with long, feather-like setae. The broad, subovate "fixed finger" of the terminal joint is lamellar and has the outer surface mosaiced with squamose, golden yellow scales. A row of these squamosities on the outer surface of the movable finger parallels the margin of the meeting surfaces.

The fifth legs are longer, slenderer, less lamellar and more cylindrical than the fourth pair; they have the basal four joints arched; the propodus is no wider than the carpus and about one-fourth longer; the finger is about one-fourth of the length of the propodus; the propodus on the upper and distal three-fourths of the outer surface bears a patch of golden squamosities and the hinged finger bears a longitudinal row of these, paralleling its inner margin. The carpus and especially the propodus and dactylus bear clusters of long setae, but these, while abundant and close-set, stand out more individually than do the feathery hair masses on the fourth legs. The paired, circular genital apertures of the male are situated on the ventral surface of the coxal joint of the fifth legs; the paired genital apertures of the female are located on the ventral surface of the second pair of ambulatory legs.

The abdomen is toughly membranous, asymmetrical, coiled and tapering; telson and terminal abdominal segments calcified. The last abdominal segment is squarish; the telson is transversely segmented, with the anterior portion deeply channelled longitudinally in the median area, the posterior margin somewhat rounded at the lateral angles; the posterior portion of the telson is a trifle longer than the

Parapagurus pilosimanus abyssorum Henderson, about natural size.
(Body encased in an anemone.)

anterior and is very convex dorsally; there are two incisions in this joint at the basal lateral angle, another two near the distal angle and one in the median distal margin; these incisions and their attendant depressions enhance the convexity of the distal portion of the carapace and permit of its fitting into the molluscan shell. The lateral and posterior margin of the proximal joint of the telson are sparsely setose, and those of the distal joint are continuously fringed with setae. The rhipidura have the basal joint, which arises from the proximal half of the telson, curiously produced and curved, marked with a slight incision at the base of the small branch, and with a deep, crooked depression at the base of the larger branch. The smaller branch is closely appressed to the basal joint and has its lower margin arcuate and the upper one curved. The outer surface is covered with golden yellow squamosities, similar to those on the propodus of the fourth leg. The larger branch of the rhipidura has two tubercles near the base, is elongated with the lower margin arcuate, and the upper rounded. The outer surface of the distal part is covered with a plate of golden yellow squamosities like those on the smaller branch. Both branches are fringed with long, feather-like setae.

SYNONYMY.—*Calcinus obscurus* SCHMITT (not Stimpson), Zoölogica, N. Y. Zoöl. Soc., vol. 5, No. 15, p. 170, 1924.

Calcinus explorator BOONE, Zoölogica, N. Y. Zoöl. Soc., 1930 (in press).

Subfamily: **Eupagurinae.**

Genus: **PARAPAGURUS** Sydney I. Smith, 1874.

Parapagurus pilosimanus abyssorum Henderson.

Plate 4.

NAME: Abysmal anemone hermit.

DIAGNOSTIC CHARACTERS: This species is confined to the ocean abyss and is almost invariably found in the association of the anemone which invests the gastropod mollusk shell selected by the hermit as a home. The most conspicuous characters of this hermit are the somewhat square-shaped, decidedly calcified carapace and the exceedingly long and slender ambulatory legs, the dactyli of which in some adult males are longer than the entire body.

TYPE: The type material of *Parapagurus pilosimanus* S. I. Smith was taken "probably on a trawl line, in 250 fms., hard bottom, off the coast of Nova Scotia, nearly due south of Halifax, and was inhabiting

a peculiar actinoid polyp, which had evidently first grown upon the spiral gastropod shell inhabited by the crab.

The specimens secured by the *"Talisman"* north of the Azores, Lat. N. 42° 15′, Long. 0.23° 37′ and named *P. abyssorum* by A. Milne Edwards are deposited in the Paris Museum. Prof. Milne Edwards and Prof. Bouvier subsequently designated these as subspecies of *P. pilosimanus*. Milne Edwards' manuscript name was first published by Prof. J. R. Henderson in his report on the *"Challenger"* collection of Anomura. These latter specimens are deposited in the British Museum.

DISTRIBUTION: This fascinating little hermit is the abysmal relative of the familiar littoral hermit crabs despite its bathymetrical range, which is from 625 to 1900 fms. It has been recorded from all of the great ocean beds, with the exception of the Southern Ocean between the Cape and Australia, by the *"Talisman," "Challenger," "Albatross"* and *"Ara"* expeditions.

MATERIAL EXAMINED: Two males dressed in anemone, *Epizoanthus paguriphilus* Verrill on shell *Natica* species indeterminable, dredged in 1100 fms., off Miami, Florida, March 3, 1926, by the *"Ara."*

HABITS: Like its shallow water kin, *Parapagurus pilosimanus abyssorum* (Henderson), selects a mollusk shell for its house, some of the molluskan genera thus represented being *Pleurotoma, Trochus, Dentalium, Ianthina* and *Phos*. The molluskan house is almost invariably invested with an anemone, which is believed to exert a solvent action on the shell. In the majority of the specimens I have examined and also of those elsewhere recorded, the shell has become so wasted that it is indeterminable, while in several instances the shell has entirely disappeared and the anemone forms a saccular covering for the hermit. Nothing is really known of the why and wherefore of this curious bit of commensalism beyond the obvious inference that the smaller would-be devourers of the hermit's misshapen, soft body themselves risk becoming victims of the voracious death-dealing tentacles of the anemone, while the latter, member of a group of home-abiding, sessile organisms has apparently satisfied some mysterious longing to travel, and become a quaint, peripatetic philosopher of the abyss, who seemingly has discovered that the economics of anemone existence in the abyss are best served by this old-man-of-the-sea life. Two species of deep-sea anemones, *Epizoanthus paguriphilus* Verrill and *E. abyssorum* Verrill, have been recorded as forming the carcinoecum of *Parapagurus pilosimanus abyssorum* in the Atlantic; of these, *E. abyssorum* is the more abundant form.

COLOR: The exposed parts of the hermit's body and appendages are the color of old ivory, with a faint suggestion of safron pink tinging the chelipeds and antennae. The setae of the chelipeds are a pale golden yellow when freed from obscuring detritus.

TECHNICAL DESCRIPTION: Anterior region of carapace calcareous, very convex, somewhat squarish, smooth centrally, but with minor lateral areolations; faintly produced to a median point anteriorly, which scarcely reaches the base of the ocular peduncles; submedian points much fainter but with acute points; postcervical region swollen, submembraneous, with an anteriorly placed, subcrescentic row consisting of three pairs of regularly decreasing laterally calcareous plates.

Ocular peduncle half as long as the precervical region of carapace, dilated basally, cylindrical, slender distally; cornea terminal, placed obliquely, heavily pigmented, convex; ophthalmic scale narrow, acicular.

External antennal peduncles stout, produced beyond the eye by the entire length of the distal peduncular joint; acicule extending to the distal margin of the merus of the first ambulatory leg, long, slender, slightly sigmoid, armed with spinules on the inner margin. The basal peduncular joint is stout; the external lateral projection of the second joint is short and rounded distally; the third peduncular joint is broad and somewhat flattened; the flagellum is about two and one-fourth times the length of the entire body.

The inner antennae have the basal article about as long as the eyestalk; the second article subequal; the third article about as long as the two first articles taken together; the flagellum biramose, the superior branch is the slenderer, dorsoventrally flattened and consisting of eight rings, fringed distally with a few setae; the inferior branch is cylindrical, dilated basally, decidedly tapering distally, one and one-half times as long as the superior flagellum and heavily fringed along the dorsal margin, with a dense brush of long, closely placed setae.

The right cheliped is about as long as the body uncoiled and has the basis and ischium short; the merus somewhat shorter than the carpus, sigmoid, subtriangulate in a dorsal view, smooth on the inner surface, granulose on the outer surface and densely pubescent on the ventral surface; the carpus is about as long as the hand without the fingers and is dorsoventrally depressed, cylindrical, with the dorsal surface granular, the ventral surface both granulose and pubescent; the hand is similar to the carpus but more dilated; the fixed finger is

projected at an obtuse angle to the lower margin, and its upper surface bears two irregular, compound teeth and several tufts of setae; the movable finger is similarly dentate, slightly incurved and granulose on its outer border. The left cheliped is much slenderer and shorter than the right, the greatest width of the left (that of the hand) being less than the width of the right carpus near its base. The fingers of the left cheliped are longer than its hand, whereas those of the right cheliped are shorter than those of the right hand.

The ambulatory legs are fantastically long and slender; the first pair exceed the length of the great cheliped by the length of the dactylus, which is slightly longer than the propodus. The second ambulatory legs exceed the first in length by about half the length of the dactylus. The ambulatory legs are decidedly laterally compressed, their meral, carpal and propodal joints have the dorsal end, in a less degree, the outer lateral surfaces granular, while the sabre-like dactyli are smooth, obscurely channelled longitudinally, slightly tortuous, and apically acute and bordered on the upper and lower margins just behind the apex, with a series of 8 to 10 spine-like setae.

The fourth and fifth pairs of legs are lamellose and have their borders fringed with fine hairs.

The abdomen conforms to generic characters. The penultimate segment bears a distinct depression; the last segment has its posterior margin finely crenulate.

SYNONYMY.—*Parapagurus abyssorum* A. M. Edwards, Mss., in Henderson, Rept. *"Challenger"* Anomura, p. 87, pl. 9, 1888.

Parapagurus pilosimanus var. *abyssorum* A. M. EDWARDS et BOUVIER, Ann. Sci. Nat. Zoöl., 7 eme, Ser. XLII, p. 205, 1872.—FAXON, Mem. Mus. Comp. Zoöl., vol. 18, p. 68, 1895.

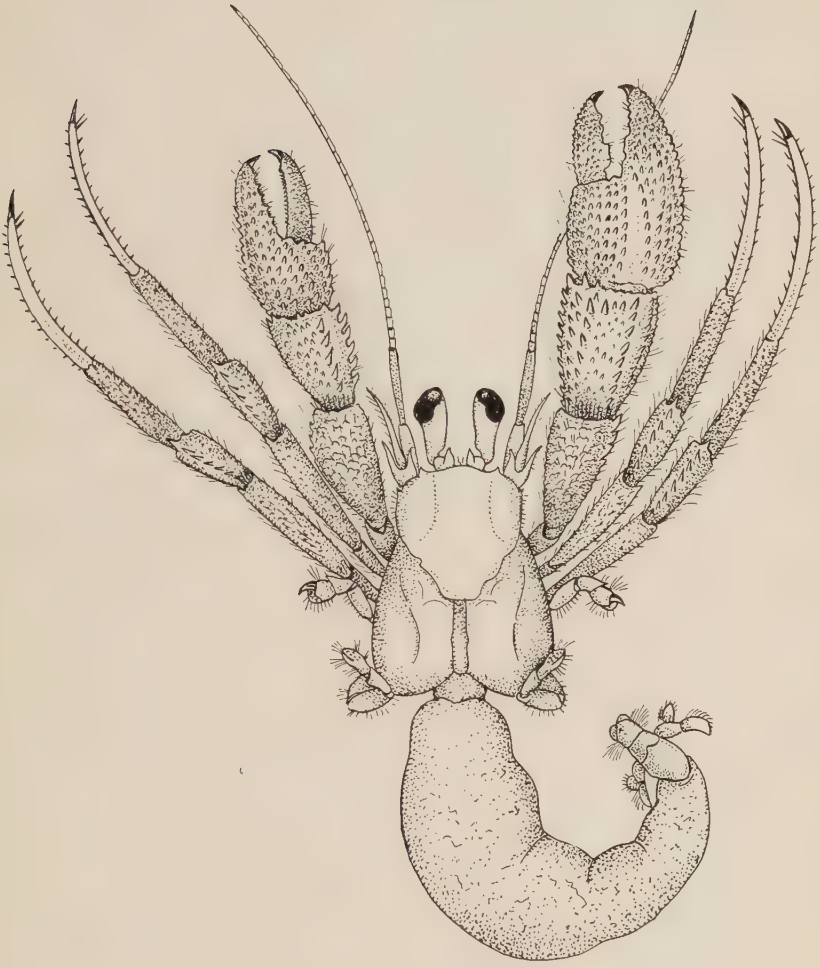
Genus: **PAGURUS** Fabricius.

Pagurus albus (Benedict).

Plate 5.

DIAGNOSTIC CHARACTERS: The ivory color of this species is its outstanding field character. The long, slender, great cheliped, which has two longitudinal rows of small denticles bounding a depressed region and extending the length of the carpus and palm, readily identify this species.

TYPE: Dr. Benedict's type came from the Gulf of California and is deposited in the United States National Museum.



Pagurus albus Benedict, ×3.

DISTRIBUTION: This species, which has hitherto been known only from several stations in the Gulf of California, has its southern range extended to Punta Arenas, Costa Rica, by the *"Ara"* material.

MATERIAL EXAMINED: One specimen from Punta Arenas, Costa Rica, March, 1928, by the *"Ara."* One, Canos Island, Costa Rica, February, 1928.

COLOR: Ivory.

TECHNICAL DESCRIPTION: Anterior region of carapace with the median projection triangulate, separated from the lateral projections by a concave margin; the lateral projections are also triangulate, quite as robust or slightly more so, and produced as far forward as the median projection; the apex of the lateral projection is a short, sharp spine which arises from the margin; the outer part of the frontal margin is gently rounded and continues backward into the lateral margin. The carapace is rather broadly ovoid, the anterior region covered by a broad, soft, calcareous shield which is wider anteriorly and rounded posteriorly; there are three submedian tufts of long setae on this shield; the posterior median dorsal plate of the carapace is narrow, depressed, membranous, scarcely defined from the similar, globose posterior lateral regions; there are longitudinal series of tufts of long setae on the median and posterior regions of the carapace also.

The posterior region of the body is asymmetrical, soft, coiled; the penultimate segment is semicalcareous; the telson is transversely segmented, the proximal part being approximately half as long as the distal part, slightly asymmetrical and bilobed by a median longitudinal sulcus; the distal portion of the telson has a pair of incisions midway the lateral margins, at which point the distal half of this article is abruptly bent under; the posterior margin is slightly asymmetrical, with a small median incision, and is armed along its entire margin with a series of irregular jagged teeth. The peduncle of the uropoda is very substantial, being quite as long or longer than the larger branch; the latter has its outer distal face covered with a series of scales which form an elliptical patch, which is fringed around with long setae; the smaller branch of the uropod is closely appressed to the side of the peduncle and projects only a trifle beyond it distally; the outer distal face of the smaller branch also bears an elliptical patch of scales.

The chelipeds are large, markedly unequal, the smaller one scarcely reaching the base of the propodus of the large chela. The large cheliped is long and rather slender; the merus has a few spinose granules

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Seattle, Washington.

on its distal border; the carpus is about as long as the palm and granulose with two longitudinal ridges of denticles on the upper surface; the area between these ridges is usually, but in old specimens not always, sunken; the propodus is twice as long as wide and also has two longitudinal ridges, composed of denticles on its upper surface and in line with those of the carpus; these regions have a depression between them and terminate at the base of the fingers; the remaining surface of the propodus is granulose, and the outer lateral margin is denticulate; the fingers are long, slender, not gaping.

The first and second ambulatories are quite long and slender, exceeding the great cheliped by two-thirds the length of the dactyl; the dactyli are very acuminate, each being one and one-half times as long as its related propodus; there is a deep longitudinal groove on each face of the dactyl, extending from its base almost to the tip. The meral joint is spinulose on its upper distal surface.

The fourth and fifth legs offer no specific characters.

The eyestalks are stocky, constricted at the base of the cornea, which is substantially larger than the stalk. The ocular scales are short, subtriangular, wide at the base, with an obscure subterminal spine.

The acicules are not quite as long as the eyes.

SYNONYMY.—*Eupagurus albus* BENEDICT, Proc. U. S. Nat. Mus., vol. 15, p. 6, 1892.

Pagurus bernhardus (Linné) *s. s.* Brandt.

Plate 6.

TYPE: Linnaeus states: "*Habitat in Oceano Europaea, intra varius testis concharum.*"

DISTRIBUTION: A deep-water species known from the coasts of northern Europe and eastern North America, subarctic in the North Atlantic, depth from 5 to 180 fms.

COLOR: Bright cherry red.

MATERIAL EXAMINED: One specimen inhabiting the mollusk shell, *Crassidromus lineatus* (Linné) on top of which is attached an anemone, *Actinauge rugosa* Verrill, dredged in 180 fms., entrance to the Bay of Islands, Newfoundland, September 3, 1926.

TECHNICAL DESCRIPTION: Precervical portion of carapace about heart shape in contour, with the frontal margin produced to a broad triangular rostral point and with the submedian or lateral points also triangular but not quite so prominent; the postcervical region is about as long as the precervical, the skin tough and finely setiferous, with

Pagurus bernhardus (Linné) Brandt, natural size.

the postlateral lobes convex, the median posterior region excavate for the abdomen; the latter is asymmetrically coiled, encased in tough membrane, except the pretelsonic segment which bears a nearly square calcareous plate on the upper surface; the proximal part of the telson is unequal-sided, about two-thirds as large as the preceding calcareous plate; the distal part is flexed under, unequal-sided, roughly subcircular, with the lateral margins with an approximately median incision, the lobes thus formed, rounded; the distal margin incised in the median line, also rounded, the right side smaller than the left. The uropoda are very unequal, the left one being about three times as large as the right; they are of similar shape, with a stout peduncle, which is nodular distally; the outer blade is small, auricular, except that the apex is pointed; the outer margin has a crescentic patch of scales; the inner blade is twice as long as the outer and very strong, of approximately the same shape distally but with a longer base proximally, also with a crescentic band of scales and a marginal fringe of setae. There are three small appendages on the left side of the abdomen; each has a slender, slightly curved peduncle, a linear anterior blade about two and a third times as long as the peduncle, the posterior blade smaller than the peduncle.

The ocular scale is small, lobate, the lateral margins convex, convergent distally to an acute tip. The eyestalk is short, one-half as long as the precervical part of the carapace, thick, cylindrical, widening distally, the cornea large, spherical, terminal.

The antennulae are slender, the proximal joint short, the second and third joints slender, clavate, the third longer than the second; the two-branched flagellum stocky, short, the upper branch with a brush of short cilia; the antennulae extends beyond the eye for a distance equal to two-thirds the length of the eyestalk.

The antennae have a very long slender flagellum, which extends almost to the tip of the dactyl of the cheliped. The proximal antennal joint is short, nearly as wide as long and produced to an acute, triangulate tooth at its outer distal margin, the acicule is slender, slightly bowed, the apex acute, outward directed; the second peduncular article is very short, cylindrical, not reaching to midway the acicule; the third article is slightly longer, slenderer, reaching to the tip of the acicule; the flagellum consists of about one hundred annulations.

The chelipeds are unequal, the right one being much the larger. The merus is laterally compressed; the carpus is as long as the merus and

thickens distally, with the inner, outer and upper surfaces granulose, the upper surface with two longitudinal rows of spinules; the palm is as long as the carpus, a carina of spinose granules extending obliquely from the proximal margin of the propodal finger back to the base of the palm, forming a prominent ridge, the outer surface of the palm, especially the lower part, is very roughly granulose. The propodal finger of the smaller claw is triangular, as long as the palm, the tip corneous and the cutting edge set with truncate, corneous teeth; the hinged finger is much slenderer, with the tip also corneous; there is a narrow, button-hole-shaped gape between the fingers.

The first and second ambulatories are subequal to each other, but those of the right side are distinctly longer than their mates on the left side; the first right ambulatory has the merus 18.5 mm. long, strongly compressed laterally; the carpus is 12.5 mm. long; the dactyl is 20 mm. long; the propodus and dactyl are stocky but compressed laterally, the upper outer surface granulose and set with numerous stiff setae; the dactyl is thick, sickle-shaped, tapering and is armed on its distal half with numerous horny spines which are set in approximately two rows along the inner and outer lateral margins; the tip is also set with a horny nail. The first left dactyl is similar to the right one, except that it has the following measurements: merus, 14 mm. long; carpus, 11.5 mm. long; propodus, 12.5 mm. long; dactyl, 17 mm. long.

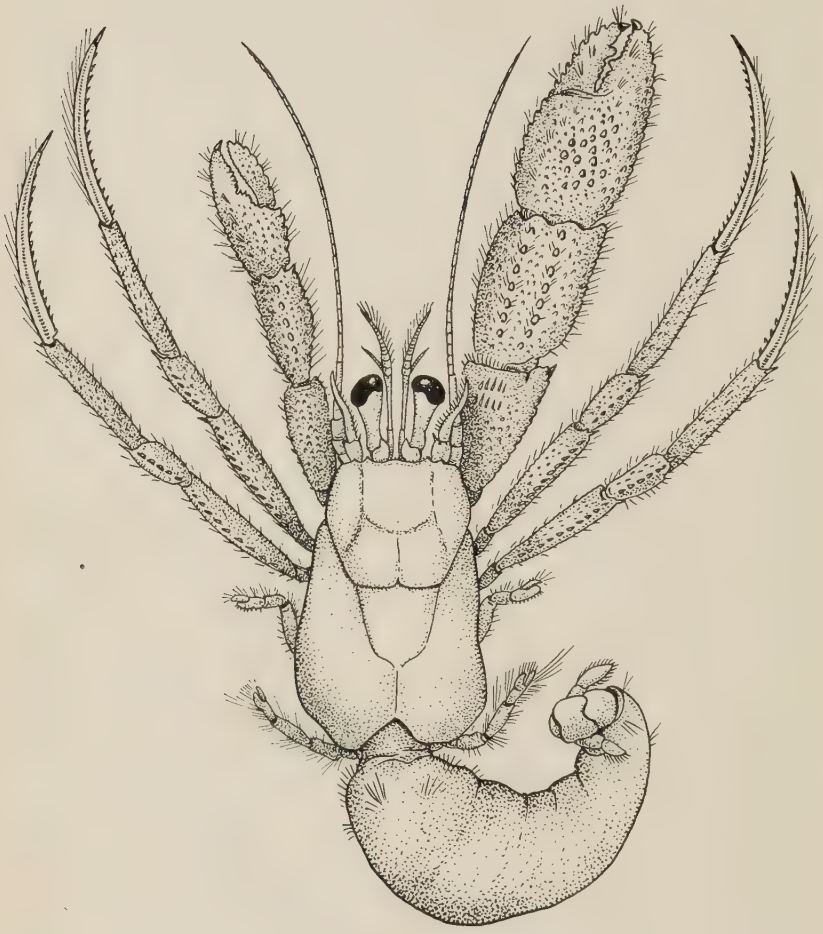
The fourth legs are very short and stocky and strong; the propodus is short, about as wide as long, with the lower lateral margin convex, the lower anterolateral angle forming a blunt tooth; a patch of horny scales on the distal half of the lower margin; the dactyl is short, thick, curved, its horny apex applied to and extending beyond the tooth-like process of the propodus, creating the superficial appearance of a chela.

The fifth legs are small, arched beside the body, the entire distal part of the palm covered with corneous squamae; the dactyl is very small, short, with the distal margin bluntly rounded and fitting into the spatulate propodal finger, both with the margins set with short, corneous spinules; the dactyl with a thick brush of very long setae.

SYNONYMY.—*Cancer bernhardus* LINNÉ, Syst. Nat., ed. 12, p. 1049, 1766.

Astacus bernhardus PENNANT, Brit. Zoöl., vol. IV, p. 30, pl. 18, 1777.

Pagurus bernhardus FABRICIUS, Species Insect, t. I, p. 506, 1781.



Pagurus longicarpus Say, ×3.

Eupagurus bernhardus Stimpson, Proc. Acad. Nat. Sci. Phila., 1858, p. 74.—S. I. Smith, Proc. U. S. Nat. Mus., vol. 3, p. 428, 1880.—J. Bonnier, Catal. des Crust. de Concarneau, p. 40, 1887 (and synonymy). E. L. Bouvier, Feuille des Jeunes Naturalists, 26e anneé, p. 154, fig. 21, 1896.—Verrill, Rept. Comm. Fish and Fisheries for 1883, p. 553, 1885.—Verrill, Rept. U. S. Comm. Fish and Fisheries, p. 548, 1871-72.

Pagurus ulidiae Thompson, Rept. Brit. Assoc. Adv. Sci., p. 267, 1843.

Pagurus streblonyx Leach, Crust. Malac. Brit., pl. 24, figs. 1-4, and text opposite.

Pagurus longicarpus Say.

Plate 7.

Name: Commonly known as the little hermit of the New England region.

Diagnostic characters: Carpus of chelipeds as long as the related palm. Chelae granulose on the outer face.

Type: Say's type merely states: "Very common in our estuaries; are generally seen near the edge of the water, running actively about seeking food" (from "An Account of the Crustacea of the United States"). Deposited in the cabinet of the Philadelphia Academy of Natural Sciences.

Distribution: Littoral on the coast of the United States from Massachusetts southward to Mexico.

Material examined: Eight specimens inhabiting the shells of *Littorina littorea* Linné from the shores of Northport Harbor, Long Island, N. Y., September 11, 1928.

Technical description: Precervical portion of carapace about as wide anteriorly as long, heart-shaped, with the frontal margin produced to a very obscure median point and similarly weak lateral points, lateral margins convex anteriorly, convergent posteriorly; postcervical region soft, about as long as the precervical lobes, swollen anteriorly, narrowed posteriorly. Abdomen asymmetrically coiled, soft, pretelsonic segment with a broad, shield-shape calcareous plate; proximal part of telson with a broad calcareous plate, about three-fourths as long as that of the preceding segment; distal part of segment twice as long as the proximal part, lozenge-shaped, with a slight incision midway the lateral margin and with the distal margin regu-

larly concave, bent, the left distal angle more produced than the right; the postlateral and distal margins spinulose. There are unusually strong uropoda, that of the left side being the larger. The peduncle is stocky, with the outer surface rounded. The anterior blade is much the larger, with the lateral margins convergent distally, the upper one convex, the lower one concave; both lateral margins are fringed with long, stiff bristles, and there is a crescentic patch of pointed, erectile, corneous scales on the distal part of the blade. The lower blade is similar to the upper but only one-third as long. The opposite uropod is scarcely half as large as the left one, which it resembles. There are three abdominal appendages; each has the peduncle nearly one-third as long as the large anterior blade, which has the distal margins rounded, ciliate; the second blade is very rudimentary, tapered, less than half the width of the peduncle.

The ocular scale is scarcely one-third as long as the eyestalk, heart-shaped with the convex lateral margins converging to an acute tip. The eyestalk is very stout, one-third as wide as long, cylindrical; the cornea is terminal, spherical, shining black, composed of many minute facets.

The antennulae are slender; the first and second articles clavate, subequal, together extending to the base of the cornea; the third article is similar to the second and approximately one-third longer, the upper branch of the flagellum is composed of 12 short rings, and is stocky, tapering, about as long as the second peduncular joint, and is furnished with a dense brush of setae on the lower margin. The inferior branch of the flagellum is slender and only half as long as the superior branch, consisting of six rings.

The antennae have the proximal joint small, broad basally and produced to an acute tooth at the outer distal angle; the acicule is slightly curved proximally, slender, acuminate, its tip reaching as far forward as the outer margin of the cornea, the inner lateral margin of the acicule set with long, stiff bristles.

The external maxillipeds offer no specific characters.

The chelipeds are conspicuously unequal, the right being the larger. The merus is rounded on the upper surface and has two or three transverse, spinous rugae; the carpus is as long as the related palm; the smaller carpus laterally compressed and with transverse rugae; the larger one as wide as the palm and with the upper surface rounded with a double row of prominent spinules separated by a groove on the inner half, the remaining outer half convex and granulose. The

palm is two-thirds as wide as long, thick, the upper surface slightly convex and very granulose, these granules coarser and forming a bead along the outer lateral margin; the fingers are short, triangular, subequal, with curved tips and granulose outer surface.

The first and second ambulatories are subequal, and those of the right side are subequal to those of the left; the merus, carpus and propodus are short; the dactyl is greatly elongated, subequal to the propodus and carpus taken together, curved, tapering, acuminate with a longitudinal groove on the outer face and with numerous bristly setae.

The fourth legs are small, with the propodus short and broad, with its posterior margin rounded distally and furnished with a band of movable scales and bristles; the acuminate tip of the propodus is closely appressed to the proximal part of the small dactyl, which has the anterior lateral margin convex, its posterior lateral margin nearly straight and set with spinules, a cluster of setae at the tip.

The fifth legs are characteristically weakly chelate, with a bunch of stiff hairs distally; the distal half of the outer face of the propodus and dactyl are set with squamose, flexible scales.

Synonymy.—*Pagurus longicarpus* Say, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 163, 1817.—H. Milne Edwards, Hist. Nat. des Crust., vol. 2, p. 237, 1834.—Gould, Invert. of Mass., p. 330, 1841.—DeKay, Nat. Hist. N. Y., Zoöl., part 1, Crust., vol. 6, p. 20, pl. 8, fig. 22, 1844.—White, Cat. Crust. British Museum, vol. 25, p. 59, 1847.—Leidy, Journ. Acad. Nat. Sci. Phila. (2), vol. 3, p. 149, 1855.—Rathbun, Occas. Papers Boston Soc. Nat. Hist., vol. 7, p. 15, 1905.—S. I. Smith, Rept. U. S. Fish. Comm., vol. 1, p. 549, 1871-72 (1873).—Kingsley, Proc. Acad. Nat. Sci. Phila., p. 326, 1878.—S. I. Smith, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 47, 1879.—R. Rathbun, Rept. Fisheries Indust. U. S., vol. 1, p. 779, 1884.—Kingsley, Standard Nat. Hist., vol. 2, p. 56, 1884.—Leidy, Proc. Acad. Nat. Sci. Phila., p. 333, 1888.—Stebbing, Hist. Recent Crust. (International Science Series LXXIV), p. 163, 1893.—Paulmier, 58th Ann. Rept. N. Y. State Mus., vol. 4, p. 136, 1904 (1906).—Mayer, Seashore Life, p. 94, fig. 63, 1906.—Fowler, Proc. Acad. Nat. Sci. Phila., vol. 65, p. 64, 1913.—Fowler, Report N. J. State Museum, 1911, Crust., p. 374, vol. 13.—Sumner *et al.*, Bull. U. S. Bur. Fish., vol. 31, p. 667, 1911.—Hay and Shore, Bull. U. S. Bur. Fish., vol. 35, p. 411, pl. 29, fig. 13, 1918.

Pagurus calidus Risso.

Plate 8.

TYPE: Described without specific locality cited, in Risso's "Histoire Naturelle des Crustacés des Alpes Maritimes."

DISTRIBUTION: Mediterranean Sea and the adjacent shores of the Atlantic Ocean, the coasts of Spain and Portugal, also the Canaries, Madeira and the Cape Verde Islands.

MATERIAL EXAMINED: Ten specimens dredged in 65 fathoms, eleven miles N. W. of Lissa Island, Dalmatia, Adriatic Sea, September 13, 1924, by the *"Ara,"* William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Precervical region of the carapace widest anteriorly, with the frontal margin rounded in the median region, lateral points shallow, acute, another minute tooth at the anterolateral angle; postlateral margin convex; postcervical region soft, tumid; abdomen asymmetrical, coiled, the pretelsonic segment with a broad, rectangular, calcareous plate; proximal part of the telson unequal-sided, smaller than the plate on the preceding segment, distal part of the telson flexed under, one and one-half times as long as the proximal section, with the lateral margins convex, each with a short incision, and are a little convergent distally; the distal margin is a little incised by a V-shaped sinus and bears a few spinules. There are three abdominal appendages on the left side; each appendage has the peduncle approximately as long and wide as the subequal blades.

The ocular scale is lobate, with the apex acuminate. The eyestalks are short, thick, wider distally, the cornea terminal, spherical, of greater diameter than the stalk, shining black.

The antennulae are slender, about two and one-half times the length of the eyestalk, the first and second joints combined reaching as far forward as the eye, the third joint about equal to the two preceding; the flagellum very short, the upper branch with a brush of cilia.

The antennae are small, the first article wide and short, an acute point at the inner distal angle; the acicule is slender, sickle-shape, the tip directed outward and reaching quite as far forward as three-fifths of the length of the third article; the second article is very short; the third article is quite slender, cylindrical, about as long as the first and second taken together; the flagellum is multiarticulate, very slender, extending as far forward as the tip of the great cheliped.

The chelipeds are decidedly unequal, the right being much the larger. The merus reaches as far forward as the tip of the eyestalk;

Pagurus calidus Risso, × 7, encased in sponge.

the smaller merus is laterally compressed, the larger one convex distally on the upper surface and spinose along the margin; the carpus is about as long as the palm, the smaller one with two divergent longitudinal rows of spines on the upper surface which widens distally, the larger carpus thick on the inner surface; the upper, outer face nearly flat, armed with a row of sharp spines along the inner margin, the upper surface granulose and spinose; the palm of the great cheliped is short, nearly as wide as long and thick, the outer surface covered with granules and spines; the propodal finger is triangular, almost as long as the palm, set with several coarse teeth and slightly thicker than the hinged finger, upon which it closes throughout its length. The smaller cheliped is scarcely one-fourth the size of the larger one and narrower, with the fingers slightly longer in proportion to its length.

The first and second ambulatories are subequal to each other and to those of the opposite side and are much longer than the chelipeds, the first leg exceeding the length of the small cheliped by the entire length of the dactyl. The dactyl of the ambulatory is very slender, curved, acuminate, about equal in length to the combined related carpal and propodal joints.

The fourth legs are small, with the propodus a small, wide suboval, with only a few corneous scales on its posterior lateral margin; the dactyl is curved, acuminate, almost as long as the propodus and projecting direct out beyond it like a hook.

The fifth legs are weakly chelate, the entire propodus fringed with bristly setae, the outer surface scaled.

In the very young specimens the granulose rugae are much weaker; occasional specimens are nearly smooth.

Found in the shells of *Natica, Terebra* and several other species. One of the specimens taken by the *"Ara"* was encased in a small sponge.

Synonymy.—*Pagurus calidus* Risso, Hist. Nat. Europe Merid., vol. V, p. 329, 1826.—Roux, Crust. Medit., pl. XV, 1828.—H. Milne Edwards, Hist. Nat. Crust., vol. II, p. 220, 1837.—Lucas, Anim. Arctic in Expl. Sci. Algérie, Zoöl., vol. I, pt. 1, p. 29, 1846-49.—Heller, Crust. Sudl. Europ., p. 176, 1863.—Carus, Prodr. Faun. Medit., vol. I, p. 495, 1885.—Henderson, Rept. Voy. *"Challenger"* Zoöl., vol. 27, p, 57, 1888.—Ortmann, Zoöl. Jahrb. Syst., vol. VI, 285, 1891-92.—A. Milne Edwards and Bouvier, Crust. Décap. Travailleur et Talisman, vol. I, pt. 1, p. 180, pl. 23, fig. 19, pl. 28,

fig. 21, 1900 (and synonymy).—Alcock, Catal. Indian Decap. Crust., pt. 2, Anomura, p. 170, 1905.—O. Pesta, Die Decap. der Adria, p. 216, 1918.

Pagurus setubalensis Capello, Jorn. Acad. Lisboa, vol. V, p. 124, pl. 1, fig. 1, 1876.

Pagurus diogenes Costa, Faun. Régn. Nap., Paguridae, p. 5, pl. 2, fig. 2, 1822.

Pagurus prideauxii Leach.

Plate 9.

Type: Leach's type was found by his friend Prideaux, by whom it was secured in considerable numbers in Plymouth Sound, England.

Distribution: This species has a rather wide distribution in the littoral and sublittoral zone, having been found down as deep as a hundred fathoms. It is known throughout the Mediterranean, the coasts of Portugal and Spain, the Cape Verde Islands, the British Isles and the North Sea and southwestern Scandinavia.

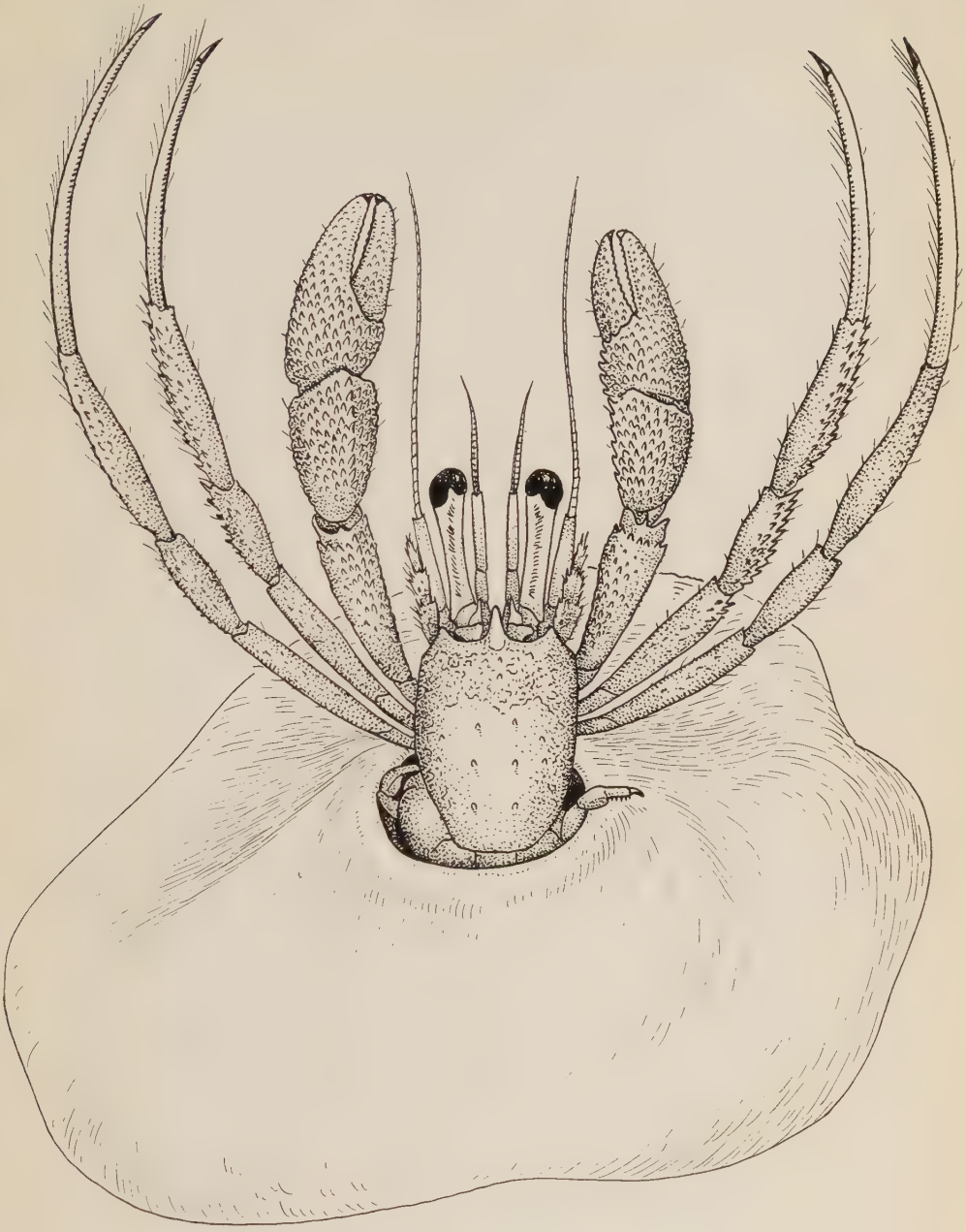
It inhabits anemones, shells and sponges with equal complacence.

Material examined: One specimen inhabiting the sponge *Suberites domuncula,* dredged in 100 fathoms, 9½ miles E. by S. ½ S. from Cape Bon Tunis, North Africa, July 19, 1927. One specimen also encased in *S. domuncula,* dredged in 19 fathoms, grassy bottom, 10 miles south of Cagliari, Sardinia, July 23, 1927, by the "*Ara.*"

Color: A very excellent color plate of this species is given in "Historia Natural Vida de los Animales de las Plantas y de la tierra," T. II, Invert., plate opposite p. 468, (1925).

Technical description: Precervical portion of carapace ovate-shield-shape with the frontal margin produced to an acute, prominent, triangulate median tooth on either side of which is the widely spaced, less prominent lateral point; the lateral margins are parallel anteriorly, rounded, posteriorly confluent with the convex posterior margin; the postcervical region is not quite as long as the precervical and is very wide and convex, the dorsal plate narrow, soft, the lateral lobes rounded; the abdomen is soft, asymmetrically coiled; the tip with the usual shell-locking device.

The ocular scale has the proximal part wide, with its margins convex and the distal three-fifths produced to an acute triangulate tip, which is directed forward and extended beyond the rostral tip. The



Pagurus prideauxii Leach, inhabiting sponge, *Suberites domuncula*, × 6.

eyestalks are large, cylindrical, five-sixths as long as the precervical part of the carapace, with an irregular line of hairs on the upper margin, the cornea hemispherical, of slightly greater diameter than the stalk, composed of many fine facets, shining black.

The antennulae, when extended, have the distal peduncular article about one millimeter longer than the cornea; the proximal joint is short, the second and third peduncular articles are clavate, laterally compressed, almost equal; the two-branched flagellum has the superior branch multiarticulate, slightly longer than the third pedunculate article; the lower branch is very setose, about as long as the last pedunculate article.

The antennae are very slender, about two and one-half times the length of the eyestalk; the peduncular first joint is produced to an acute tooth on the inferior lateral margin and supports the acicule on the upper; the acicule is triangular, very tapering, with a row of spinules on each lateral margin, the tip extending slightly outward and as far forward as the base of the antennal flagellum.

The external maxilliped is long, the meral article has its inner lateral margin armed with a row of spinules; the three-jointed palp is thick and set with short bristles.

The chelipeds are slightly unequal, the left being the larger; the merus extends about as far forward as the cornea and is laterally compressed with the upper distal margin serrulate; the carpus is triquetral, elongate, the upper and outer faces being wider distally, about equal to the palm in width; the inner lateral margin is armed with a row of spines, and the entire upper face is covered with spinous granules; the palm is not quite as long as the carpus, with the inner lateral face wide, at right angles from the outer face, which is scarcely at all convex, slightly oblique and entirely paved with spinulose granules, which form a row of spinules along the inner and less so along the outer lateral margins; the propodal finger is about as long as the palm and similarly granulose, with the outer margins spinulose, the tip meeting that of the upper finger, their marginal contour rounded. The hinged finger is similar to the propodal finger but not quite so thick; both have the cutting edge finely denticulate, the tip corneous, that of the upper finger with an acute horny tooth; a fine fringe of cilia below the teeth.

The first and second ambulatories are longer than the great cheliped and are subequal to each other, and those of the right side are subequal to those of the left. The ischial joint is elongated, the meral

joint extends as far forward as that of the cheliped and is decidedly laterally compressed; the carpus is four-fifths as long as the merus and similarly compressed; the propodus is a trifle longer than the carpus, also compressed, with the superior lateral margin spinulose and granular; the dactyl is a trifle longer than the carpus and propodus considered together and is very slender, compressed cylindrical, curved, with the upper and lower margins ciliate, the tip horn-like, acuminate.

The fourth legs are small, with the propodus squarish, the inferior lateral margin with a line of corneous scales; the dactyl is placed at the end of the propodus, stocky, with a curved tip and the lower margin spinulose.

The fifth legs are characteristically reflexed, weakly subchelate, with a large patch of movable corneous scales on the outer face of the propodus and dactyl.

SYNONYMY.—*Pagurus prideauxii* LEACH, Mala. Podopth. Brit., tab. 24, figs. 5 and 6, and text opposite, 1815.—DESMAREST, Consid. sur les Crust., p. 178, 1825.—LATREILLE, Encyc. Meth., pl. ccix, fig. 1, 1825.—MILNE EDWARDS, Ann. des Sci. Nat., 2e ser., t. vi, p. 268, 1836; Hist. Nat. Crust., t. II, p. 216, 1837.—LUCAS, Anim. art. de l'Algérie Crust., p. 28, 1849.—BELL, British Stalkeyed Crust, p. 175, 1853.—WHITE, Popular Hist. Brit. Crust., p. 75, 1857.

Pagurus bernhardus RISSO, Crust. de Nice, p. 53, 1816.—COSTA, Fauna del Regno di Napoli, p. 3, 1845.

Pagurus solitarius RISSO, Hist. Nat. de l'Eur. Merid., t. V, p. 40, 1826.—ROUX, Crust. de la Med., pl. 36, 1828.

Eupagurus prideauxii STIMPSON, Proc. Acad. Nat. Sci. Phila., 1858, p. 75.—HELLER, Crust. Sudl. Europa, p. 161, taf. V, figs. 1-8, 1863.—HENDERSON, Proc. Royal Phys. Soc. Edinburgh, vol. 9, 1885-88, p. 69.—MILNE EDWARDS and BOUVIER, Crust. Decap. Hirondelle, Monaco, 1894, p. 73; Crust. Décap. Travailleur et Talisman, pt. I, p. 241, 1900.—ALCOCK, Catal. Indian Decap. Crust., pt. 2, Anomura, p. 182, 1905.—O. PESTA, Die Decap. der Adria, p. 239, fig. 73, 1918 (and major synonymy).

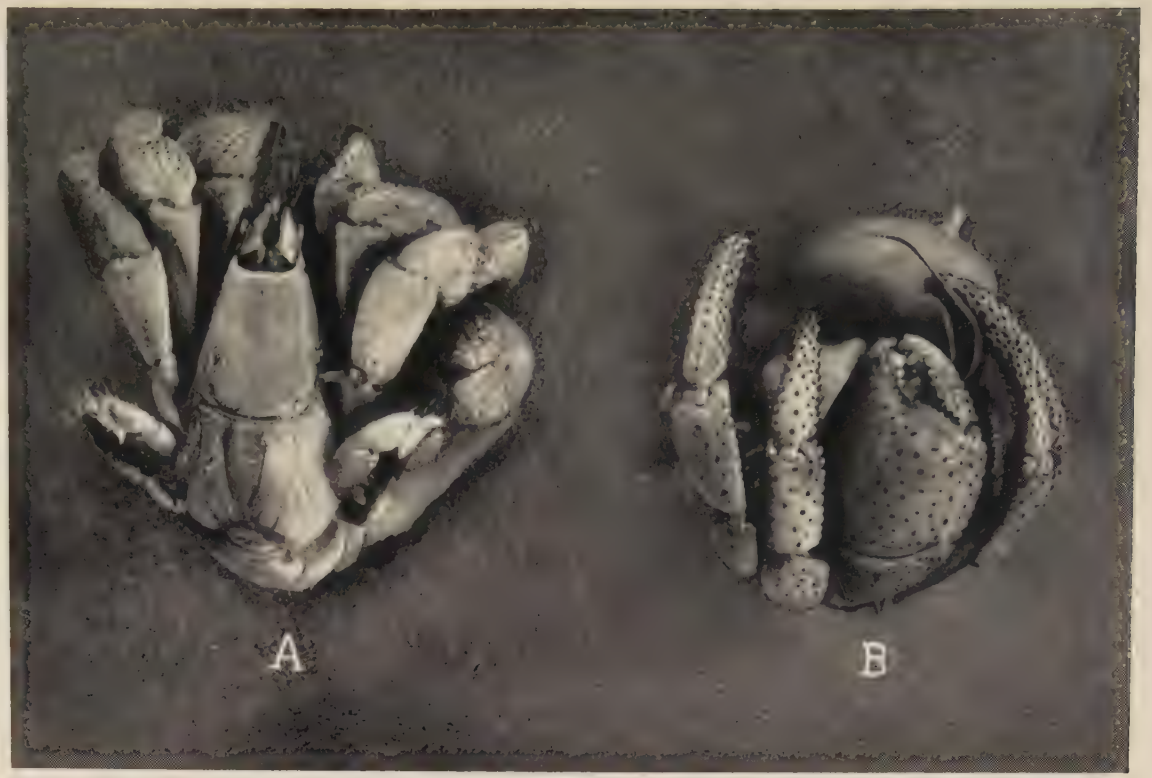
Family: COENOBITIDAE.

Genus: COENOBITA Latreille.

Coenobita clypeatus (Herbst).

Plate 10.

DIAGNOSTIC CHARACTERS: The only land hermit of the West Indian region. It is readily distinguished by its massive purplish blue left



Coenobita clypeatus (Herbst), natural size.

chela and the strong, stocky ambulatory legs, the left one of the second pair having the propodus wide, compressed. The eyestalks are also compressed but much less so than in the American west coast species, *C. compressus.*

TYPE: Herbst's type came from the East Indies, according to his text. However, Doflein pointed out that the type in the Berlin Museum was unquestionably the West Indian species.

DISTRIBUTION: Confined to the West Indian faunal region, having been repeatedly recorded from southern Florida and the Keys and nearly all of the West Indian Islands, as far south as northern Brazil. One fossil specimen from Bermuda in the shell, *Livona pica,* has been reported by Dr. A. E. Verrill and is deposited in the Peabody Museum, Yale University.

MATERIAL EXAMINED: Two specimens from the shores of Corrientes Bay, Cuba, February 22, 1924, collected by William K. Vanderbilt; one specimen (dry) from the Florida Reefs, 1923.

COLOR: In life this species is bright red, except the great claw, which is a vivid purplish-blue.

TECHNICAL DESCRIPTION: Carapace twice as long as wide, precervical region about as long as the postcervical, subrectangular with the lateral margins converging slightly anteriorly and terminating in an acute tooth between which the frontal margin is nearly straight, without a median point; the sidewalls are almost at right angles with the dorsal surface and are hard, calcareous; on the upper surface there are numerous coarse punctae and along the lateral margin a few fine cilia. The postcervical region widens posteriorly and has the postlateral angles forming rounded lobes; the upper surface is calcareous and the lateral walls are covered by a tough membrane and set sparsely with short setae.

The abdomen is covered with a tough integument and bears on its upper surface thickened semicalcareous wrinkles, indicating the obsolete segmentation; the pretelsonic segment and telson are small, calcareous and bent under, forming a device by which the crab holds onto the shell house. The pretelsonic segment bears a semioval calcareous plate on the upper surface; the proximal part of the telson is unequal-sided, being much shorter on the left side; the distal section is also lopsided, the right side being the smaller, its lateral margins each have a median incision, on either side of which the margin is

moderately convex, as is also the distal margin, which is fringed with heavy brown setae. The uropoda are very unequal, the one on the right side being the smaller. The left one has the peduncle stout, curved, with its posterior distal end projecting beyond the base of the blade and furnished with a row of movable scales; the hinder blade is short and thick, with its outer distal margin rounded and set with a band of flexible scales; the anterior blade is twice as large as the other one, stocky, with the distal margin convex and the distal half of the upper blade is covered by a patch of flexible scales; its outer margin is fringed with setae.

The abdomen bears three appendages on the left side; each of these is short, two-branched, with short setae; the first branch is little more than half as long as the second branch; on the right side there is no vestige of appendage.

The ocular scale is twice as long as wide, with the distal half of the lateral margins granulate, convergent, forming a triangulate tip to the scale. The eyestalk is one-half as long as the precervical portion of the carapace, with the upper margin slightly rounded and the inner and outer lateral faces compressed, forming a keel on the lower margin. The cornea is small, shining black, terminal, with a small projection of the stalk upon the dorsal surface.

The antennulae are well developed, the basal joint bulbous proximally, slender distally, the second and third articles quite long, laterally compressed, the third joint being slightly longer than the second; the larger branch of the flagellum is one-half as long as the third articles and consists of 18 stocky rings, which are slightly compressed laterally and are furnished with short, stiff setae; the antennulae are fused distally; the short branch of the flagellum is but little more than half as long as the larger branch and is much slenderer; each ring is tipped on the inferior margin with long stiff hair.

The antennae have the basal joint short, flattish, with the upper distal end forming an obtuse point; the acicule is stocky proximally, tapering distally, its tip blunt, setose, extending almost to the distal margin of the second joint, which is compressed, about as wide as long, its distal end reaching to the base of the cornea; the third joint is about as long as the eyestalk and is strongly compressed laterally; the flagellum is slender, consists of about 85 rings, its tip extending almost to the tip of the great cheliped.

The chelipeds are markedly unequal, the right one being small, shorter and only slightly wider than the adjacent ambulatory leg,

while the left cheliped is very massive and distinctly longer than its adjacent ambulatory, with the merus of the cheliped strongly compressed; the carpus nearly two-thirds as long as the merus; its upper surface is convex and the propodus is very massive, broadly oval, convex on the upper surface, the propodal finger thick, three-fifths as long as the palm, armed with two large teeth distally and several smaller ones proximally. The hinged finger is not quite as thick as the lower one. The small cheliped resembles the larger one but is more compressed and has its dactyli furnished with more numerous tufts of short setae. The inner upper margin of the palm of both chelae bears a brush of fine thick setae.

The first ambulatories are slightly unequal, the dactyl of the right side being a trifle longer and more curved; both have the dactyli stout, curved, with a sharp claw at the tip. The second pair of ambulatories are longer than the first pair and the right second leg is much longer than the left second leg. The right leg has its propodus wide, compressed, its dactyl much elongated, curved and tipped with a sharp nail; the dactyl is one and one-fourth to one and one-fifth times as long as the left dactyl. Both chelipeds and ambulatories have the exposed upper surfaces of the carpus, propodus and dactyl set with brown, corneous scales, which are elevated anteriorly and usually have one or more stiff setae arising in front of them. These scales increase the grasping power.

The fourth legs have the carpus with a distinct tooth at its anterior distal angle; the propodus rounded distally and with a large, suboval plate of flexible scales; the dactyl is small, acuminate and not extending beyond the propodus.

The fifth legs are chelate, the fingers spatulate; the entire propodus and dactyl covered with brush-like setae, which are used in arranging and cleansing the eggs; there is also an elongate oval patch of scales on the outside of the propodus.

SYNONYMY.—*Cancer diogenes* GEORGE EDWARDS, in CATESBY, Nat. Hist. Carolina, Florida and the Bahama Islands, vol. 2, 1771, No. 33.—LINNAEUS, Syst. Nat., ed. 12, not ed. 10, p. 1758.

Cancer clypeatus HERBST, Naturg. d. Krabben u. Krebse, vol. 2, 1791, p. 22, pl. 23, fig. 2A and B.

Pagurus diogenes LATREILLE, Encycl. Méth. Hist. Nat., Insectes, vol. 8, p. 632, tabl. —, part 24, 1818, pl. 284, figs. 2 and 3.

Coenobita diogenes H. MILNE EDWARDS, Hist. Nat. Crust., vol. 2, p.

240, pl. 20, figs. 11-14, 1837.—Bouvier, Bull. Soc. Philom. (8), II, p. 143, 1889-1890.—Ortmann, Zoöl. Jahrb. Syst., p. 316, pl. 12, fig. 21, 1892.—Nobili, Bull. Mus. Torino, No. 280, p. 3, 1897.—Rathbun, Mary, Ann. Inst. Jamaica, vol. 1, art. 1, p. 42, 1897.—Benedict, Bull. U. S. Fish. Comm., vol. 20, part 2, p. 1901.—Alcock, Catal. Indian Decapod Crust., part 2, Anomura, facs. 1, p. 193, 1905.

Coenobita clypeatus Doflein, Sitz. Math. Phys. K-B. Akad. Wissenschaften Band 29, 1899, p. 186, and Band 30, 1900, p. 133.—Alcock, *op. cit.*, note the synonymy, p. 193.—Rathbun, Rapport betreffende een Voorloopig Onderzoek naar den Toestand van de Visscherij en de Industrie van Zeeproducten in de Kolonie Curaçao, 1907, p. 329.

Family: LITHODIDAE.

Genus: **LITHODES** Latreille.

Lithodes maia (Linné).

Plate 11.

Type: Linnaeus in the Tenth Edition states that this species inhabits the oceans of Europe.

Material examined: One specimen taken in dredge in 200 fms. of water, nine miles southwest by west of Port Basque, Newfoundland, September 1, 1926, by the *"Ara,"* William K. Vanderbilt, commanding.

Color: Entire upper surface vivid scarlet. Sternal plastron somewhat paler, but deeply tinged with scarlet.

Technical description: Carapace pyriform, widest through the median and posterior region, the male usually smaller and more spinose than the female, which has a broader aspect. The rostrum in the male is one-third as long as the carapace and is directed forward and upward; there is one long, acute basal spine on the ventral surface, directed forward and downward. The apex is bifid, consisting of two divergent, acute spines; midway the rostrum there is a second pair of divergent, acute, upward-directed spines, and just above the base there is a smaller pair of upward-directed spines. The postorbital spine is acute, forward-directed, a trifle longer than the eye; the entire lateral and posterior margin is armed with acute, slightly upcurved, outward-directed, conical spines; there are two on the hepatic

Lithodes maia (Linné), one-half of natural size.

margin, the second of which is very large; another spine is just behind this in the depression formed by the cervical groove; the branchial region has eight such spines on its lateral and postlateral margins, and there is a submedian pair on the intestinal margin, making a total of thirteen spines on each half of the carapace margin, besides which there are one or two secondary spines between the large spines of the branchial margin. The entire dorsal surface is very rough and uneven. The cervical groove is deep, and there is a pronounced depression between the hepatic and branchial regions, which is continuous posteriorly with the strong urogastric depression; the cardiac region is lightly circumscribed. The entire dorsal surface is rough, with small spinous granules of irregular size and position interspersed among the larger spines which ornament it. There is a median longitudinal row of spinous granules extending from the posterior half of the rostrum to down the gastric region. There is also a submedian pair of spines on the anterior gastric region, just behind which there is an arcuate transverse line of seven or eight spinules, behind which there is a submedian pair of spinules. There are two submedian pairs of small spines, one behind the other, on the cardiac region; there are five or six conical spines placed irregularly on the summit of the branchial region. The pterygostomian region and lateral wall are also very roughly granulose.

The abdomen is large, asymmetrical, with the proximal joint nearly half an inch long and armed with a pair of large, conical, submedian tubercles near its anterior margin; there is a row of eight spines along the posterior margin, of which the submedian pair are the largest and the marginal spine the smallest; there are two other spines on the lateral margin of this segment; the remainder of the abdomen is composed of closely placed asymmetrical plates, which are roughened with blunt tubercles.

The eyestalk is small, normally directed obliquely outward, the cornea spherical, terminal, shining black.

The inner antennae have the proximal article short, the second and third articles clavate, the flagellum very short, hirsute, its extended tip reaching as far forward as the rostral tip.

The external antennae have the peduncular joints about as long as those of the antennulae; the acicule is represented by an acuminate, spine-like blade which reaches as far forward as the distal margin of the second pedunculate joint; the flagellum extends as far forward as the base of the propodus of the extended chelipeds.

The external maxillipeds have the ischium armed with teeth on the inner lateral margin; the merus is narrower; the three-jointed palp is stocky.

The chelipeds are moderately unequal, the right being the larger; the ischium is elongated, produced to an acute point on its under distal side and with three or four stocky spines on its outer face; the merus reaches as far forward as the rostrum and is compressed cylindrical, roughened with coarse granules and armed with eight or nine thorn-like spines on the upper surface, the longest of which is placed subdistally at the inner angle; the carpus is three-fourths as long as the merus, and wider on the slightly convex upper surface, which is armed with about a dozen spines, the three decidedly longest of this series being placed along the proximal half of the inner lateral margin; the palm of the larger cheliped is about as long as the carpus but slightly wider distally and armed on the outer face with 15 to 20 spines which become larger along the superior margin. The fingers are about as long as the palm, subequal, with an elliptical gape, the tips meeting; the lower finger with two or three molariform teeth, the upper finger with one large and several small teeth; numerous clusters of bristly setae along the margin of the cutting edge of both teeth. The smaller cheliped resembles the larger but is less dilated in the palm.

The second, third and fourth legs are of similar structure and subequal in length; each has the merus seven-eighths as long as the maximum width of the carapace; the carpus is half as long as the merus and slenderer; the propodus is about one and three-fourths times as long as the carpus and equally slender; the dactyl is five-sixths as long as the propodus, tapering, acuminate, sickle-shaped, with three or four spines proximally, the tip acute, spine-like. The distal end of the ischium, the upper and especially lateral borders of the merus, carpus and propodus are furnished with a series of long, thorn-like spines, those of the meral borders being the largest.

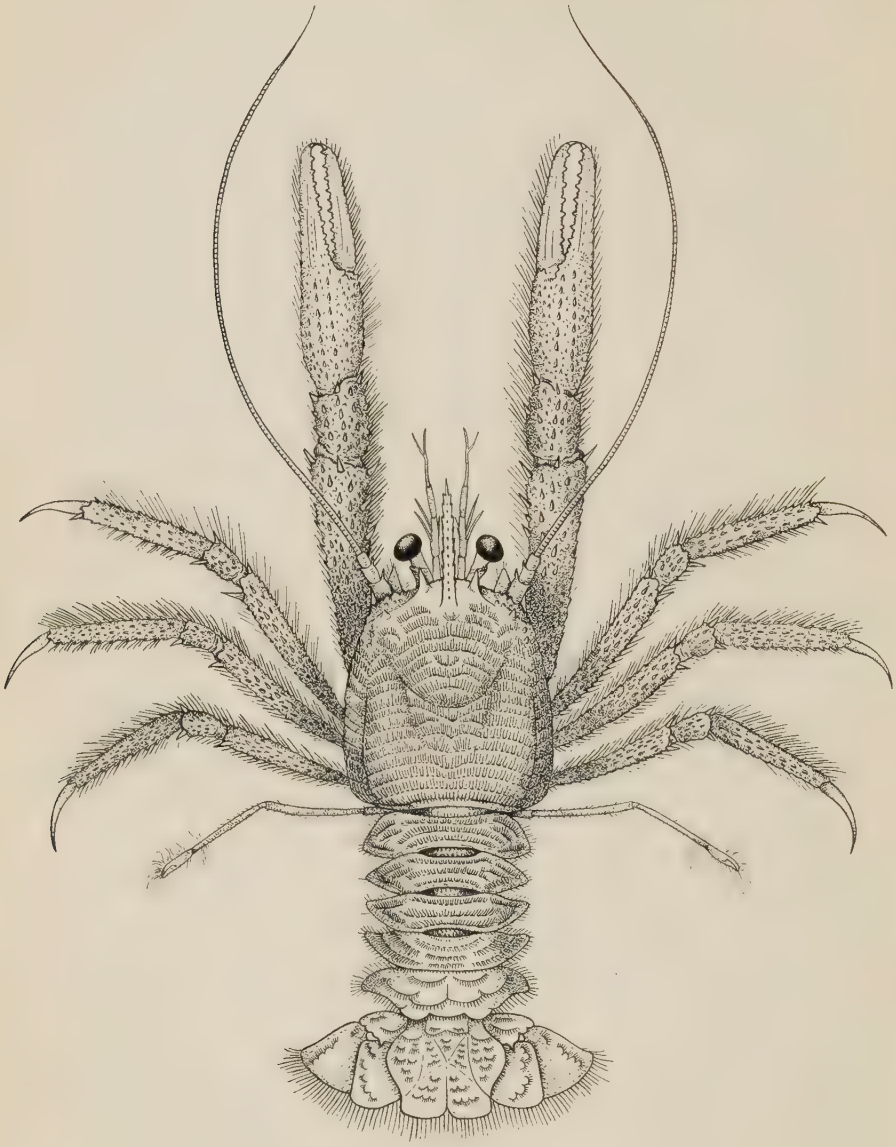
The fifth legs are characteristically weak, folded within the branchial cavity.

SYNONYMY.—*Cancer maja* LINNÉ, Syst. Nat., vol. 1, No. 1046, p. 41, Ed. Tenth; Twelfth Ed., No. 2031, 1768.—HERBST, Naturg. Krabben u. Krebse, vol. 1, p. 219, tab. 15, fig. 87, 1788.

Cancer horridus PENNANT, Brit. Zoöl., vol. 4, p. 7, pl. 7, fig. 14, 1771-78.

Inachus maja FABRICIUS, Suppl. Ent. Syst., p. 358, 1795.

Lithodes arctica LATREILLE, Gen. Crust. et Insect., vol. 1, p. 40, 1802.



Munida gregaria (Fabricius), ×2.

Lithodes maja Leach, Edinburgh Encycl., 7, 1814-17; Trans. Linn. Soc., vol. 11, p. 352, 1815; Malacostraca Podophthalmata Britanniae, 1815, London, tab. 24, text on opposite page (color plate).

Maia araignee Latreille, Hist. Nat. des Crust. et des Insectes, vol. 6, p. 91, Le Crabe epineux Ascan. Icon. Rer. Natur., tab. XXXX.

Lithodes maia S. I. Smith, Proc. U. S. Mus., vol. 6, p. 25, 1883.

Family: **GALATHEIDAE.**

Genus: **MUNIDA** Leach.

Munida gregaria (Fabricius).

Plate 12.

Diagnostic characters: Nearly always found in large schools; animal vivid blood-red. Carapace rectangular, with about seventeen transverse ciliated rugae. Rostrum acuminate, flanked by one pair of subrostral spines; there is one pair of spinules on the gastric region behind the subrostral spines and one branchiostegal spine on each side. No lateral spines in the adult. Abdomen without spinules, but with two transverse ridges on each segment except the telson.

Type: *"Habitat in Oceano Americano Patagoniam alluente gregaria."* Fabricius described the species from material in the private collection of Sir Joseph Banks; which collection was later deposited in the British Museum.

Distribution: Bathypelagic in both Atlantic and Pacific Oceans.

Material examined: One specimen dredged in 100 fms., Punta Arenas, Costa Rica, February, 1928, by the *"Ara,"* William K. Vanderbilt, commanding.

Technical description: Front produced to a slender, acuminate rostral spine, which is dorsally keeled, this keel extending back on the carapace briefly. The rostrum measures 4 mm. long from tip to base, or a little longer than the eye, on either side of which there is a small spine. Beyond this the frontal margin is concave; there is a branchiostegal spine just above the antennal peduncle. A pair of small, submedian spines occur on the anterior part of the carapace, on either side of the rostral carina, one behind each of the subrostral spines. There are no other spines on the carapace. The carapace is rectangular, 11.5 mm. median width, dorsal surface very convex, cervical groove deep, anterior region of carapace ornamented with about seven transverse ridges, some of which are interrupted, all are minutely punctate and are margined with a long fringe of fine amber-colored

cilia; there are about ten transverse ridges on the posterior region of the carapace; the *linea anomurica* is very distinct. The transverse ridges curve forward below it. The abdominal segments are devoid of spines; there are two transverse sculptured ridges, each anteriorly fringed with cilia; the anterior ridge on each segment is the longer, extending down on the epimera; the telson has the posterior margin evenly bilobate; there is a median longitudinal groove and the posterior suture lines are oblique; the dorsal surface has the numerous clusters of setae each arranged in a small arc. The large, fan-like rhipidura have a small spine at the inner posterior angle of the upper distal margin of the peduncle; the outer blade is smaller than the inner, both have the outer margins truncate, slightly rounded. Both the telson and rhipidura have the margins heavily fringed with long setae.

The eyes are mounted on a short stalk; the cornea is large, bulbous, subspherical.

The antennulae extend beyond the rostrum for slightly more than the length of the last joint and flagella.

The antennae have a three-jointed peduncle and a flagellum that extends to midway the fingers of the extended chelipeds.

The chelipeds are equal, 42 mm. long, slender; the ischium has a long, acuminate tooth on the inferior distal margin; the long merus is armed with an acuminate tooth on its median upper and inner distal margins. There is one (occasionally two) acuminate teeth on the inner lateral margin of the carpus and two spinules on the median upper and inner distal margins; the propodus is almost as long as the slender curved fingers, which meet along the cutting edges and overlap at the tip. The upper surfaces of the meral, carpal and propodal joints are ornamented with a series of arch-shaped granules which are anteriorly fringed with long setae; these granules are placed in close, regular formation, covering the entire dorsal surface.

The second, third and fourth legs are similar, decreasing in length posteriorly; each has the meral joint with its upper surface granulose; the long propodus and slender, acuminate dactyl are laterally compressed, the propodus longitudinally channelled, the dactyl very acuminate and slightly twisted.

Synonymy.—*Galathea gregaria* Fabricius, Ent. Syst. II, p. 473, 1793. *Grimothea gregaria* Leach, Dict. d. Sci. Nat., vol. 18, p. 50, 1820.—Dana, U. S. Explor. Exped., vol. 13, Crust., part 1, p. 483, pl.

Munida stimpsoni A. Milne Edwards, × 3.

31, fig. 1, 1852.—Desmarest, Consid. sur la classe des Crust., p. 287, 1825.

Grimotea sociale, Grimotea gregaria Guérin-Meneville, Crust. Voy. *"La Coquille,"* Zoöl., vol. 2, pl. 3, fig. 1, p. 33, 1830.

Grimothea nova zelandiae Filhol, Passage de Venus, Mission de l'Ile Campbell, p. 426, 1874 (Institute de France).

Munida gregaria Miers, Proc. Zoöl. Soc. London, p. 73, 1881.

Munida subrugosa Henderson, *"Challenger"* Report, vol. 27, 1888, Anomura, p. 124.

Munida gregaria A. Milne Edwards, Mission Scient. du Cap Horn, Crust., p. 32, pl. 2, fig. 1, 1891.—Benedict, Proc. U. S. Nat. Mus., vol. 26, p. 308, figs. 45 and 46, 1902.

Munida cokeri Rathbun, Proc. U. S. Nat. Mus., vol. 38, p. 559, pl. 53, fig. 5, 1911.

Munida stimpsoni A. M. Edwards.

Plate 13.

Type: The type series of specimens was taken at several stations in the West Indies, by the *"Blake"* and is deposited in the Museum of Comparative Zoölogy; paratypes are in the Museum National d'Histoire Naturelle, Paris, and the United States National Museum.

Distribution: West Indian region; deep-sea, ranging from shallow water of the *"Ara"* record which is a very young specimen, to 180-1105 fms., for the larger adults of the *"Blake"* and *"Challenger"* records.

Material examined: One very young specimen, from Porto Padre, Cuba, 2 fms., taken by the *"Ara."*

Technical description: This specimen, which is a very young one, conforms to Dr. Benedict's *M. flinti,* from the northern part of the Gulf of Mexico in every respect, especially in the fact that it is less spinose or granulose than is *M. affinis.* I believe that this is due to the juvenile character of my specimen and in the light of the knowledge of the extreme variation in this phase of the many species which have come to my attention in larger series, I am convinced that *M. affinis* presents an extreme form of development of the granulose carapace, of which *M. stimpsoni* may be considered the type form, and *M. flinti* the other extreme, approaching a nearly non-granulose carapace. The major spines of the three do not differ.

The rostral spine is twice as long as the eye, comparatively smooth, the supraorbital spines acute, almost but not quite as long as the orbit,

an acute, outward directed spine at the anterolateral angle and three additional lesser but well developed spines along the lateral margin, one precervical and the remaining two postcervical, all subequally spaced. There are seven dorsal spines on the dorsal precervical portion, a postorbital pair, behind which there are five spines, forming an irregular transverse row, *i.e.*, a median spine, a submedian pair in line with the postorbital pair and outside and slightly anterior to these another spine on each side of the hepatic region, nearly in line with the first lateral spine. The cervical groove is deep. There are three spines on the postcervical region, a median spine and slightly in advance of this a submedian pair. The transverse rugae and granulations are well spaced, the cilia short. There is a submedian pair of spines on the hinder margin of the carapace. The second abdominal segment has six spines, two on either side of the submedian pair; the third segment has only four, one on each side of the submedian pair; the fourth segment has only the submedian pair followed by a single median spine. The chelipeds and first three pairs of monodactylar legs are scabrous and spinose.

Synonymy.—*Munida stimpsoni* A. Milne Edwards, Bull. Mus. Comp. Zoöl., vol. 8, No. 1, p. 47, 1880.—Henderson, *"Challenger"* Rept. Zoöl., vol. 28, p. 126, pl. 14, fig. 1, 1888.—A. Milne Edwards and E. L. Bouvier, Ann. Sci. Nat. Zoöl., ser. 7, t. 16, p. 257, 1894; Mem. Mus. Comp. Zoöl., vol. 19, No. 2, p. 48, pl. 4, figs. 1-13, 1897. —Benedict, Proc. U. S. Nat. Mus., vol. 26, p. 313, 1903.

Munida flinti Benedict, *ibid.*, p. 258, fig. 9.

Munida affinis A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zoöl., vol. 19, p. 48, pl. 4, figs. 1-19, 1897.

Genus: **MUNIDOPSIS** Whiteaves.

Munidopsis simplex A. Milne Edwards.

Plate 14.

Type: The species was founded upon a series of specimens taken at nine *"Blake"* stations, at Guadeloupe, Dominica, Martinique and St. Vincent, at depths ranging from 484 to 982 fathoms; the material was divided between the Paris Museum and the Museum of Comparative Zoölogy.

Distribution: As above and extended northward by the *"Ara's"* catch off Miami, Florida, depth 1100 fms.

Material examined: Eighteen specimens of various sizes dredged in 1100 fathoms, off Miami, Fla., March 31, 1926, by the *"Ara."*

Munidopsis simplex A. Milne Edwards, × 3.

TECHNICAL DESCRIPTION: Carapace rectangular, three-fourths as wide as long, produced to an upcurved, attenuated, acute rostral spine, which is three-fifths as long as the carapace, with the upper surface paved with squamous rugae; the inferior lateral margins carinate, these carinae continuous on the frontal margin; anterolateral angles nearly right-angled, with an acute spine arising from the tumid hepatic lobe; lateral margins subparallel; the precervical portion of the carapace is circumscribed by the deep cervical groove and is tumid; there is a pair of submedian spinules behind the rostrum on the anterior gastric region; between these is a brief longitudinal ridge; posterior to this is a single median spinule, the three spinules outlining a triangle; a short distance behind the single spine is a pair of smaller submedian spinules on the precervical region; the postcervical region is nearly as long as the precervical; there is a deep, transverse depression in the urogastric region, above which the carapace is carinated and armed with one forward-pointing median spine; the posterior margin is heavily carinated. The entire dorsal surface of the carapace is roughened by broken, transverse granules, some of which are coarser than others.

The abdomen has the first segment rudimentary; the second and third segments each have a conspicuous transverse carina anteriorly, which is ornamented with an acute forward-pointing median spine, in addition to the above-mentioned carinae; the second and third segments each have a prominent transverse carina across the median region just anterior to the posterior margin; the second segment has the epimera widely triangular, while those of the third, fourth and fifth segments are extremely narrow and attenuated, triangular; the third segment has no spine and only one transverse carina on the median region not far behind the anterior margin; the fourth and fifth segments are smooth; the sixth segment is narrower than the others, with its postlateral margins converging, its posterior margin relatively straight; the telson is small, shield-like, with oblique suture lines; the rhipidura have a stout peduncle, the outer blade slightly the smaller, narrow proximally, broadly widened and rounded distally; the inner blade is much wider than the outer, with its distal and inner lateral margins very convex; both blades are ciliated.

The cornea is short-stalked, bulbous.

The antennulae have the proximal joint large and armed with one very long, acuminate, up- and outward pointing spine on the superior, subdistal margin; just below this there is a large, two-forked spine,

both placed above the base of the second joint, while below it is another similar, two-jointed spine.

The antennae have the basal joint armed with an acute spine at the outer distal angle; the second article has two spines, one at the upper and one lower, outer distal angle; the third article has one very long spine at the outer distal angle; the flagellum is about as long as the chelipeds and consists of 75 rings.

The external maxillipeds have the ischium wider distally and armed with an acute tooth at the outer distal angle; the merus is slightly longer than the carpus and is armed with two very acuminate, conical, outpointing teeth on the lateral margins and with the distal margin excavate, its outer angle forming a short, acute tooth; the palp is long, three-jointed, ciliated.

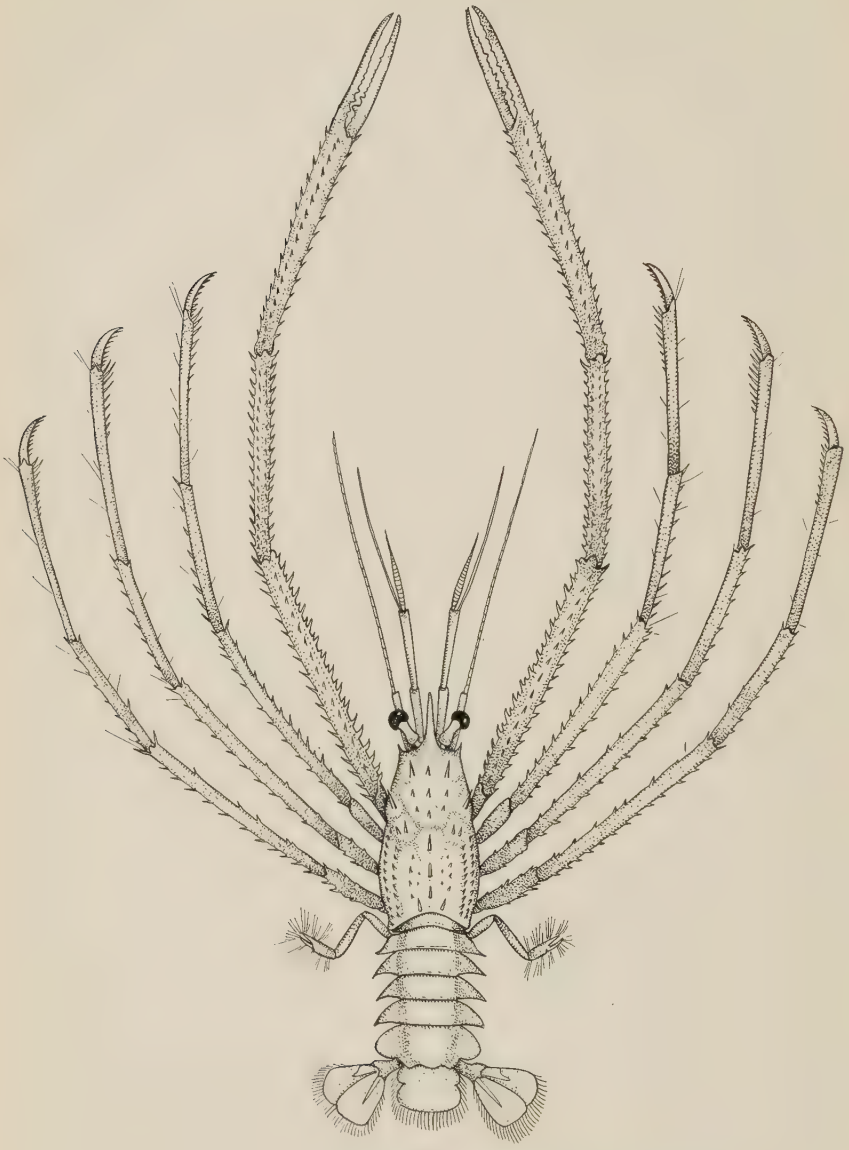
The chelipeds are equal, of moderate size, 52 mm. long, the ischium produced to an acute point on its inferior distal margin; the merus is roughened by rugose scales, with three or four spines on the inner lateral margin and with three at the respective angles of the distal margin; the carpus is similar to the merus but only one-third as long, with three acute spines at the distal margin, two above, one ventral; the propodus is about as long as the merus, with the palm slightly longer than the fingers, cylindrical; the fingers are slender, subequal, cutting edge finely, regularly crenulated, tips curved, meeting. The entire cheliped is covered with rough, squamous rugae.

The second, third and fourth legs are similar, slightly decreasing in length posteriorly; the merus cylindrical, elongate, rough with granules; the carpus short; the propodus very slender, about as long as the merus; the dactyl is about two-thirds as long as the related propodus, curved, acuminate and armed on its inferior lateral margin with a continuous row of stout, short spines, between which are tufts of short setae.

The fifth legs are short, rudimentary, reflexed upon the back, subchelate, with the propodus and dactyl furnished with a brush of long setae.

SYNONYMY.—*Galathodes simplex* A. MILNE EDWARDS, vol. 8, p. 56, 1880.

Munidopsis simplex A. MILNE EDWARDS and E. L. BOUVIER, Ann. des Sci. Nat. Zoöl. (7), vol. 16, p. 275, 1894; Mem. Mus. Comp. Zoöl., vol. 19, No. 2, p. 89, pl. 5, figs. 2-7, 1897.—BENEDICT, Proc. U. S. Nat. Mus., vol. 26, p. 326, 1902.



Ptychogaster spinifera A. Milne Edwards, ×1.5.

Genus: **PTYCHOGASTER** A. Milne Edwards.

Ptychogaster spinifera A. Milne Edwards.

Plate 15.

TYPE: A female taken by the *"Blake,"* at station 167, Guadeloupe, is designated by Dr. Milne Edwards as type and is deposited in the National Museum d'Histoire Naturelle, Paris.

DISTRIBUTION: West Indies and Caribbean Sea at depths ranging from 123 to 366 fms. Taken by the *"Blake"* at Fredickstadt, 180 fms., Guadeloupe, 183 fms., Santa Lucia, 154 fms., Grenadines, 127 fms., Caricou, 163 fms., Barbados, 124 fms., and by the *"Pawnee,"* north of Glover Reef, Caribbean Sea, 366 fms. The *"Ara"* specimen taken seven miles southwest of Alligator Reef, Florida, establishes the northernmost record for the species.

MATERIAL EXAMINED: One specimen dredged seven miles southwest of Alligator Reef, Florida, in 150 fms., March 30, 1926.

COLOR: In life this species is a rich, semitranslucent old ivory.

TECHNICAL DESCRIPTION: Rostrum slightly longer than the eye, slender, acuminate, upward- and forward-directed, with the inferior lateral margins lightly carinate, these carinae continuous on the superior orbital margin. Carapace 13 mm. long from base of rostral spine to posterior margin, rostrum 3 mm. long; carapace 9 mm. maximum width across the median region. The precervical region is elevated, convex; the cervical groove is deep; there are a pair of acuminate up-pointing teeth, placed subdistally, one behind each orbit; behind each of these spines are two smaller, widely spaced spinules; behind and diagonally in line with this large spine are two more shorter spines; there are three medium-sized spinules subequally spaced in the median line of the precervical region; there is also a large, subdistal spine on the hepatic region. The median postcervical region is elevated and bears a median row of three subequally spaced spines, continuing the row on the precervical region; on either side of the median row there are about eight spinules, forming two irregular, longitudinal series, the upper of which terminates in a high, acute spine on the posterior margin of the carapace. The median lateral part of the postcervical region has a longitudinal row of four or five long spines, on either side of which are a number of irregularly spaced spinules; the *linea anomurica* is sharply defined and below and subparallel to it is a longi-

tudinal row of eight or ten spines and below this a number of smaller, irregularly spaced spinules.

The first abdominal segment is short, with a median transverse elevation and the epimeral angles acute, up- and out-curved triangles, with the apex scarcely extending beyond the lateral margin of the carapace; the second to fifth abdominal segments, inclusive, are much longer and wider than the first segment and have the epimera produced to long, acute triangles; the sixth segment is long but with the epimera forming wider triangles. The telson is slightly wider than long, with the small, lateral lobes rounded and separated from the large median lobe by a notch; the distal margin is broadly rounded and fringed with fine cilia. The rhipidura have a stout peduncle and two broad suboval blades, fringed with cilia; the outer blade is slightly the wider. In the usual folded-under position of the abdomen, the epimera fit upon each other, forming the sidewalls to a roomy cavity beneath the body in which the eggs and embryos are kept.

The sternal plastron has a strong median groove, the transverse sutures are distinct and there is at the base of the cheliped a strong, acute spine.

The eyes are on short, flexible, bulbous stalks, constricted at the base of the cornea, which is large, spherical, composed of many facets.

The chelipeds are 90 mm. long, the ischium being short, 3 mm. long, and terminating distally in an acute tooth; the merus is 31 mm. long; the carpus 20 mm. long; the propodus 22 mm. long; the dactyl 14 mm. long; there is a series of sharp, out- and forward-pointing spines on each lateral margin of the ischium, merus, carpus and propodus; the latter has two additional submedian rows of spines on the upper margin. The fingers are slender, meeting with numerous, sparsely placed long hairs; the cutting edges are set with irregular sharp teeth; the finger tips meet.

The first, second and third pairs of ambulatory legs are very long and slender and are armed with spines along both lateral margins.

The fifth legs are small, of the typical small size, reflexed, weakly chelate.

Synonymy.—*Ptychogaster spinifer* A. Milne Edwards, Bull. Mus. Comp. Zoöl., vol. 8, No. 1, p. 64, 1880; Mem. Mus. Comp. Zoöl., vol. 19, No. 2, p. 35, p. 118, pl. 9, figs. 16-22, pl. 10, figs. 4-16, 1897. —Benedict, Proc. U. S. Nat. Mus., vol. 26, p. 334, 1902.—Boone, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 61, 1927.

Lepidopa venusta Stimpson, ×1.5. A, profile; B, ventral; C, dorsal view.

Family: **ALBUNEIDAE.**

Genus: **LEPIDOPA** Stimpson.

Lepidopa venusta Stimpson.

Plate 16, figs. A, B and C.

DIAGNOSTIC CHARACTERS: This species is distinguished from its ally, *L. scutellata* by the submedian teeth of the frontal margin being nearer the median tooth than is the case in *scutellatus;* the feet of *venusta* are very similar, but the dactyl of the second legs is more sharply excised and the dactyli of the third and fourth legs are much slenderer.

TYPE: The type was taken at St. Thomas, W. I., and is believed to be no longer extant.

DISTRIBUTION: St. Thomas, Fort Macon, Beaufort, N. C., and Miami Beach, Florida.

MATERIAL EXAMINED: Nine specimens, including both sexes, taken at Miami Beach, Florida, March, 1924, by William K. Vanderbilt.

COLOR: In life this species is a rich old ivory, with an opalescent rose sheen. The many cilia are golden yellow.

TECHNICAL DESCRIPTION: Carapace shield-shape, only slightly convex, with the median longitudinal region moderately elevated, or ridged, and with numerous deeply etched transverse lines, one behind the frontal margin and one, the urogastric, being especially strong. The frontal margin is produced to a broad, median, triangulate rostral point, on either side of which the frontal margin is excavate above the base of the ocular scale and then gently convex, forming an acute, more prominent and broader triangulate tooth on each side of the rostrum; there is a short acute tooth at the anterolateral angle and running in from this obliquely is a groove, ciliated; the lateral margins of the carapace are uneven, slightly converged posteriorly; the posterior margin is concavely excavate in the median region, thence nearly straight on each side and sharply carinate. The abdomen is short, with the hinder three segments flexed under the body. The first segment is visible only in the median place, excavate between the carapace and second segment, and is almost entirely covered with stiff, short setae. The second segment is slightly wider than the carapace, with the lateral parts wider than in the median line and forming broad, rectangular, almost squarish plates with the distal angles right-angled, the anterior and lateral margins ciliate; the third seg-

ment is only about half as long as the second and has the lateral plates tapering, with an acute angle anteriorly and the posterior margin convex; the fourth segment is similar to the third but much smaller, with the lateral parts more abbreviated; the fifth segment is quite narrow but longer than the fourth, with the lateral margins oblique, convergent posteriorly; the sixth segment is small, squarish; the telson of the female is broadly heart-shaped, almost subcircular, with a median, longitudinal suture proximally; the rhipidura have the peduncle about as long as the sixth segment and thick, slightly wider distally; the blades are oval, ciliate marginally, slightly unequal, the inner being the wider, with its postlateral side more convex than the opposite side; the outer blade is narrower proximally but more evenly oval; both are strongly ciliated.

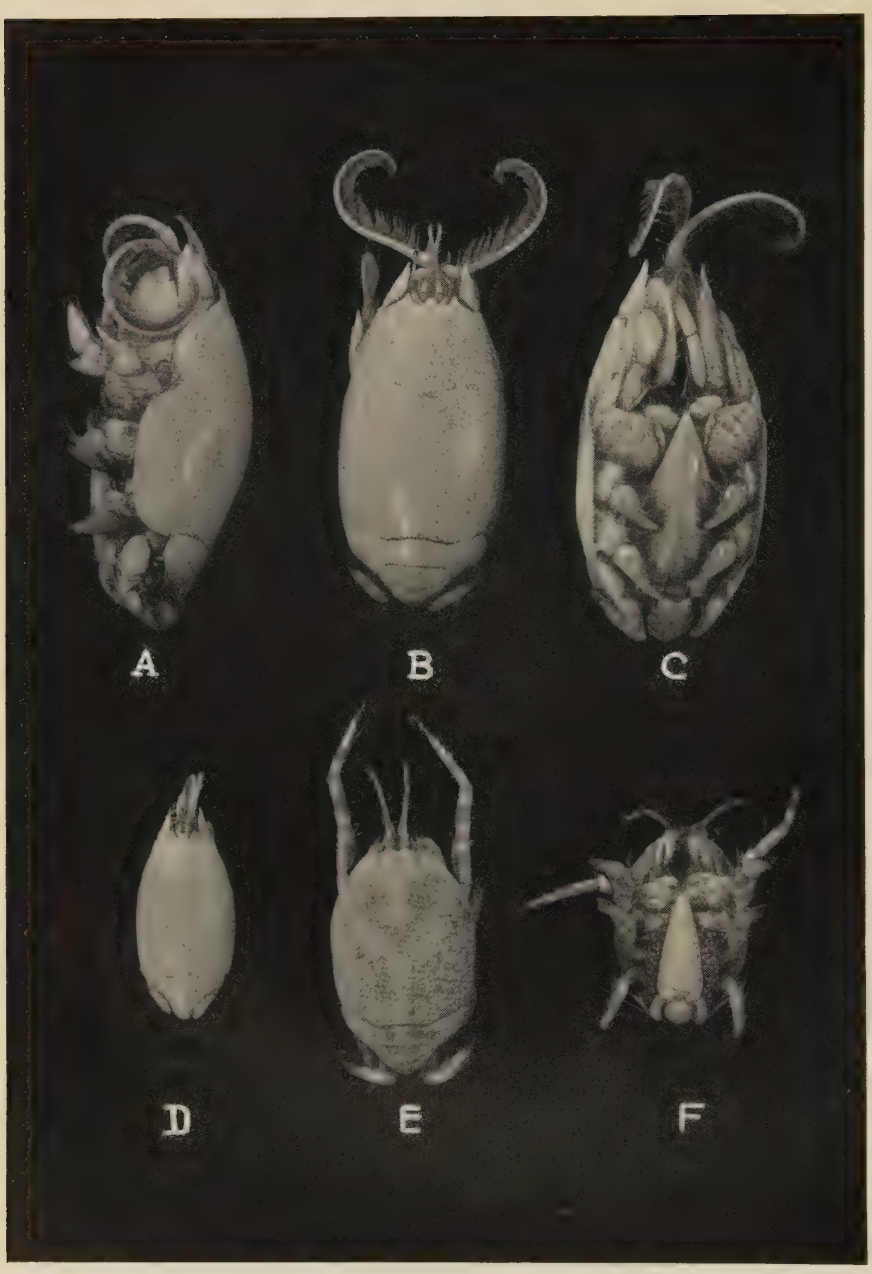
The female abdominal appendages are attached to the third, fourth, and fifth segments and are very long, two-branched.

The ocular plates are large, squarish, with the angles rounded, the margins crenulated and ciliated.

The antennulae are almost twice as long as the carapace and very setiferous; the first article is of a curious, irregular shape, concave on the upper surface; the second article very wide on its outer face, of curved, irregular shape; the third article is small, laterally compressed, its inferior margin convex; the inferior branch of the flagellum is extremely rudimentary, consisting of a long and a short ring, setose; the superior flagellum consists of 91 joints, each of which bears on its inferior and superior margin a comb of five long setae.

The antennae are small, the tip reaching little more than a third the length of the antennulae; the proximal joint stocky, a spine on its outer margin; the acicule is small, lanceolate, the remaining articles successively decrease in size; the flagellum is composed of eight stocky, laterally compressed, tapering rings and has a brush of long setae on the under side.

The first legs are chelate, the merus large, suboval, thick, arched to fit against the body, the carpus is elongate, with the outer surface slightly convex and with several transverse rugae; the propodus is greatly flattened and widened and curiously shaped; the lower margin is carinate and slightly convex, the tip is curved, acuminate, and the cutting edge is very convex and setose; the free upper margin is deeply rounded, and the attached proximal margin is angled, corresponding to the angle of the carpus; the finger is very slender, long, curved, sickle-shaped, with its outer margin fringed with setae.



Emerita emerita (Linné), natural size. A, B, C, females; D, male, showing average difference in size between the sexes; E and F, female, *Emerita analoga* Stimpson.

The second, third and fourth legs are approximately similar and not greatly differing in size; all have the meral joint inconspicuous and the carpal joint greatly enlarged, with the anterior margin convex and the anterior distal end forming a rounded triangular lobe; the third leg has the carpus much larger and the distal angle longer than do the other legs; the propodus is short and thick, much wider than long, with the dactyl arising from the distal end, resting upon the distal and inner lateral margin of the propodus, which is shaped for this; the dactyl is very large and curiously shaped, the posterior lateral margin being regularly convex and the anterior margin truncate for a short space and then deeply concave, thus forming a subbasal tooth and a distal tooth which is somewhat sickle-shape; the basal tooth of the third leg is bluntly triangular; on the fourth leg it is narrow, more attenuated, sickle-shaped; on the fifth leg it is a broad, acuminate triangle.

The fifth legs are linear, weak, the ischium greatly elongated, subequal to the merus; the carpus is three-fourths as long as the merus but slenderer; the propodus is three-fifths as long as the carpus and has a short, stocky lower finger, which, together with the minute dactyl, forms a miniature chela; there is a thick tuft of setae on the distal end of the propodus.

The eggs are small, spherical, ivory, about three hundred to the female.

SYNONYMY.—*Lepidopa venusta* STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, p. 79, 1859; Proc. Acad. Nat. Sci. Phila., p. 230, 1858.—HAY and BENEDICT, Proc. U. S. Nat. Mus., vol. 26, p. 892, 1903.—HAY and SHORE, Bull. U. S. Bur. Fish., vol. 35, p. 415 (see remarks under *Lepidopa websteri*), 1918.

Lepidops venusta MIERS, Journ. Linn. Soc., vol. 14, p. 332, 1879.—KINGSLEY, Proc. Acad. Nat. Sci. Phila., vol. 31, p. 410, 1879.

Family: HIPPIDAE.

Genus: EMERITA Gronovius.

Emerita emerita (Linné).

Plate 17, figs. A, B, C and D.

DIAGNOSTIC CHARACTERS: Carapace shuttle-shaped, very concave, widest in the middle; legs nonchelate, falcate; antennae very long. This species is confined to the eastern coast of North America and South America and is readily found in abundance in the tropic and subtropic regions. It is easily distinguished from its West Indian

congener, *E. cubensis* Saussure, by the fact that the latter has the carapace more depressed, wider in ratio to its length, and the antennae decidedly shorter than are those of *E. emerita.* The males of *E. emerita* are much smaller than the associated females; the pair figured show the average difference.

TYPE: Linnaeus states: *"Habitat in mari Indies";* H. Milne Edwards states that it inhabits the coasts of Brazil. Say's type came from Charleston, S. C., and is deposited in the Philadelphia Academy of Natural Sciences. Say states in his original description of the species, *E. talpoidea,* that it "inhabits the coasts of the United States. Common."

DISTRIBUTION: Known from the east coast of the United States, Central America, the West Indies and the east coast of South America as far down as the mouth of the Amazon.

MATERIAL EXAMINED: Ten specimens from Miami Beach, Florida, January, 1923.

HABITS: The life cycle of this odd little crustacean has been admirably reported by Dr. S. I. Smith (Trans. Conn. Acad. Arts and Sci., III, p. 311) and by Fritz Muller, from South American material, in his work entitled "Für Darwin" (English translation, London, 1869, p. 54, fig. 25).

TECHNICAL DESCRIPTION: Carapace oval, shuttle-shaped, 28 mm. long, 20 mm. maximum width across the middle, decidedly convex in both directions, with numerous transverse imbrications on the posterior regions, with the exception of one short, prominent, transverse line just behind the rostrum and one deep recurvate line anterior to the median region; the imbrications resemble miniature wave ripples on the sand. The rostrum is short, bluntly triangulate, separated on either side by a U-shaped sinus from the submedian pair of teeth, which are a trifle longer and narrower than the median tooth and with the tip acute; the anterolateral margins are irregularly concave and serrulate; the postlateral margins are produced, forming a covering over the bases of the legs and with the lateral edge convex.

The abdomen is flexed, so that the sixth segment and telson are beneath the body; the first segment is rudimentary, linear; the second is very wide, with the epimera rounded and ciliated on the margins; there are transverse lines on the epimera; the third, fourth and fifth segments are successively shorter and narrower; the sixth segment is about three times as long as the fifth segment, with the proximal part wider than the distal, from which it is separated by a slight line;

the telson is long, tapering, triangulate, with the lateral margins carinate, ciliated, the tip acute, the dorsal surface very convex transversely; there are two brief, longitudinal submedian lines on the base of the telson. The uropoda have the peduncle rectangular, twice as long as wide, the blades oval, approximately as long as the peduncle, almost subequal to each other, the outer blade is not quite as wide as the inner, which is nearly two-thirds as wide as long, both with ciliated margins.

The eyestalk is long, slender, curved, extending to midway the distal peduncular joint of the antennae; the basal joint lies in part of the sinus between the rostral and subrostral teeth and is covered by a hard, calcareous deposit; the second article is semiconcealed; the third article has a small, cylindrical base beyond which it narrows into the long, exceedingly slender eyestalk that measures 6 mm. long and is tipped distally with the cornea, which is of slightly greater diameter than the stalk.

The antennulae have the proximal joints lying side by side beneath the rostrum; the large acicule lies beside the under side of the distal peduncular article and extends a little beyond it. The acicule has the upper and lower margins converging, tip rounded, setiferous, outer face convex. The distal peduncular article is thick, cylindrical; the larger branch of the flagellum is thick, setiferous and consists of 42 tapering rings; the shorter branch consists of 19 longer but stocky rings and is almost as long as the upper branch; both have a dense fringe of setae along the entire upper and lower under margins.

The antennae have the acicule large, convex on the outer surface, tapering to an acuminate point distally and with another acuminate point subdistally on the upper lateral margin; the proximal joint is semiconcealed beneath the acicule; the second joint is short, bulbous, convex on the upper surface; the third article is elongate, narrowed proximally, becoming wider, subcylindrical distally; the flagellum is about 20 mm. long and is composed of numerous extremely short rings and has a dense comb of long and short thick setae along the under margin.

The external maxillipeds have the ischium greatly enlarged, forming an operculum, its length one and four-fifths times its greatest width with the inner margin convex, the article narrowing distally, its inner angle triangular; the merus is very small, squarish, with the corners rounded; the palp is two-jointed, very long, narrow and curved slightly, with the margin heavily fringed with setae.

The first legs have the merus wide, nearly subcircular, with numerous broken, transverse setose rugae, the carpus is unevenly convex on the upper surface, tapers distally and has a very acuminate spine; the propodus is short and has the lower distal angle produced into a rounded, stout blade; the lower margin is distinctly carinate, and it and the distal margin are armed with stout spines; the dactyl is a stout, oval blade, with the anterior lateral margin heavily carinate and the posterior lateral margin convex, the margins ciliate.

The second and third legs are similar, subequal, with the merus entirely concealed beneath the sidewall of the carapace; the carpus squarish, angulated at the distal angle; the propodus and dactyl falcate; the propodus excavate and produced distally to an acute blade, reinforcing the dactyl, which is concave on its anterior margin and convex on the posterior margin, forming a subcrescentic blade.

The fourth pair of legs are smaller than the third and have the dactyl with the lower lateral margin thickened, the upper lateral margin similar to and convergent with the lower margin.

The fifth legs are concealed beneath the carapace and are exceedingly slender; the ischium is nearly as long as the merus; the carpus similarly slender but shorter; the propodus elongate, it and the dactyl forming a claw, the fingers being much shorter than the palm and fringed with many setae.

SYNONYMY.—*?Cancer emeritus* LINNÉ, Syst. Nat., ed. 12, p. 1055, 1766.

?Astacus emeritus FABRICIUS, Ent. Syst., vol. 2, p. 484, 1793.

Cancer testudinarius HERBST, Naturg. Krabben u. Krebse, vol. 2, p. 8, pl. 22, fig. 3, 1796.

Hippa emeritus FABRICIUS, Ent. Syst. Suppl., p. 370, 1798.

Hippa emerita LATREILLE (?), Hist. Nat. Crust., vol. 6, p. 176, 1803.—LAMARCK (?), Hist. Anim. sans Vert., vol. 5, p. 22, 1818.—DESMAREST, Consid. Crust., p. 174, pl. 19, fig. 2, 1825.—H. MILNE EDWARDS, Hist. Nat. Crust., vol. 2, p. 209, 1837; Crust. in Cuvier R. A., ed. 3, pl. 42, fig. 2.—GIBBES, Proc. Amer. Assoc. Adv. Sci., p. 188, 1850.—DANA, U. S. Explor. Exped., vol. 13; Crust., vol. 1, p. 409, pl. 25, fig. 9, 1852.—GUÉRIN-MENEVILLE, Icon. R. A. Crust., pl. 25, fig. 2; in RAMON DE LA SAGRA, Hist. Isle de Cuba, vol. 7, Crust., p. 34, 1856.—HELLER, Crust. in Reise der Novara, p. 73, 1865.

Hippa talpoida SAY, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 160, 1817.—DEKAY, Zoöl. N. Y. Fauna, Crust., vol. 6, p. 18, pl. 7, fig. 17,

color plate, 1844.—White, Cat. Crust. British Museum, vol. 25, p. 58, 1847.—Leidy, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 149, 1855.—Verrill, Report U. S. Fish. Comm., vol. 1, 1871-72 (1873), p. 338, pl. 2, fig. 5.—S. I. Smith, *idem,* p. 546; Trans. Conn. Acad. Arts and Sci., vol. 3, p. 311, pl. 45-48, 1877.—Kingsley, Proc. Acad. Nat. Sci. Phila., 1878, p. 326.—Uhler, Chesapeake Zoöl. Labr. Johns Hopkins Univ., I, p. 26, 1878.—Stebbing, Hist. Recent Crust. (Internat. Science Series LXXIV), p. 150, 1893.—Rathbun, M. J., Occas. Papers Boston Soc. Nat. Hist., vol. 7, p. 16, 1905.—Paulmier, 58th Report N. Y. State Mus., vol. 4, 1904 (1906), p. 135, fig. 7.—Mayer, Seashore Life, p. 94, fig. 64, 1906.

Hippa talpoidea Leidy, Proc. Acad. Nat. Sci. Phila., 1878, p. 336, 1878; *op. cit.,* 1888, p. 33.

Emerita talpoida Benedict, Report U. S. Fish. Comm., vol. 20, part 2, p. 138, 1901.—Fowler, Proc. Acad. Nat. Sci. Phila., p. 3, 1911; Report N. J. State Museum, vol. 13, Crust., p. 366, pls. 109 and 110, 1911 (1912).—Sumner, F. B., Osburn, R. C., and Cole, L. J., Bull. U. S. Bur. Fish., vol. 31, part 2, p. 666, 1911.—Hay and Shore, *idem,* vol. 35, p. 416, 1918.

Nectylus rugosa Rafinesque, Amer. Month. Mag. Crit. Rev., vol 2, Nov. 1817, p. 41.

Hippa emerita Miers, Journ. Linn. Soc. London, vol. 14, p. 323, pl. 5, fig. 9, 1879.—Kingsley, Standard Nat. Hist., vol. 2, p. 59, 1884.—Ives, Proc. Acad. Nat. Sci. Phila., 1891, p. 181.—Young, Stalk-eyed Crust. West Indies, p. 349, 1900.

Emerita analoga Stimpson.

Plate 17, figs. E and F.

Diagnostic characters: The median frontal lobe is broader, less acute and not separated so widely from the lateral lobes, which are acute but far less prominent than are those of *E. emerita,* the East Coast species. The median spine of the second peduncular article of the antennae is proportionately shorter and is directed inward, while that of *E. emerita* is longer and directed outward.

Type: Prof. Stimpson's type material apparently consisted of a large series taken by a Mr. Samuels, at Tomales Bay; near San Francisco, by Trowbridge; Monterey (Taylor), and Mazatlan (Verreaux), and deposited in the museums of the Boston Society of Natural His-

tory, the Philadelphia Academy of Natural Sciences, the Smithsonian Institution, the Paris Museum and the Museum at Petrograd.

DISTRIBUTION: West coast of the Americas from California to Chile.

MATERIAL EXAMINED: One ovigerous female taken at Punta Arenas, Costa Rica, March, 1928, by the *"Ara,"* William K. Vanderbilt, commanding. One, Perlas Islands, March, 1928.

TECHNICAL DESCRIPTION: Carapace oval, shuttle-shaped, but wider in proportion to its length and not so high as is *E. emerita.* The present species is 19 mm. long, 16 mm. maximum width; with numerous fine, wavy, transverse imbrications over the entire dorsal surface; there is a short, deep, transverse line just behind the rostral region and a pair of small, crescentic pits on each side of the median region. The frontal margin is quite different from that of *E. emerita.* There are two rounded, submedian teeth separated from each other by a shallow, U-shaped sinus on either side at the base of the eye, beyond which the carapace is again produced and rounded similar to the submedian teeth and then slopes backward to the lateral margin, which is convex, deeper and in the hinder two-thirds almost or entirely concealing the meral joints of the legs. The abdomen has the first segment linear, narrow, subcrescentic; the second segment is nearly as wide as the carapace and has the lateral plates twice as long as is the segment in the median line, and evenly rounded; there are two transverse grooves on each epimeral plate, one placed nearly medially and the other just anterior to the posterior margin; neither of these grooves is continuous across the median region of the segment and both are set with a row of stiff, short setae. The third segment is only slightly wider than the median part of the second segment and not quite as long, with the anterolateral angle subacute and the lateral margin convex, sloping posteriorly; the fourth segment is shorter and narrower than the third, with the epimeral region forming an acute point anteriorly; the fifth segment is similar to the fourth but smaller and with the anterolateral angle more acute; the epimera of the third to fifth segments, inclusive, are heavily plated and carinated, the anterior margin of each of these segments bears a row of short, stiff setae; the sixth segment is nearly three times as long as the fifth, very convex transversely, with the width narrowing posteriorly; the uropoda have an elongate, curved peduncle, which is about half as wide as long, the blades are distinctly unequal, the outer blade nearly a third longer than the inner and narrower, elongate-ovate; the inner blade shorter and much wider in proportion to its length, both blades

with the margins set with close, long plumose setae. The telson is three-fourths as long as the carapace, tapering, triangulate, with the lateral margins carinate and ciliate, the tips acute, outer surface moderately convex.

The eyestalk is extremely short, narrowed proximally and widening distally; the cornea is large, terminal, dorsal, deep brown.

The antennulae have the basal joint concealed, the second joint produced into a rounded laminate plate on the lower, outer side; the distal peduncular joint is smaller than the preceding joint and is decidedly compressed laterally; the flagellum is composed of 30 stocky, tapering annulae but is short, reaching only to midway the dactyl of the extended first legs; the lower branch is four-fifths as long as the upper and not quite so thick, yet robust; each ring has a few long, stiff hairs distally, and at the end of the flagellum there is a cluster of these setae which reach as far as the end of the larger flagellum.

The antennae are not half as long as the antennulae and have the basal joint excavate, spatulate beneath the eye with the distal margin rounded; the acicule arises from the outer distal angle and is on the lower side, closely appressed to the small second article and tipped with setae; the third peduncular article is cylindrical, thick; the flagellum is subequal in length to the peduncular article and is composed of four rings, abundantly edged and tipped with long setae.

The external maxillipeds are broad, operculum-like, the ischium forming an elongate, suboval plate, with the outer surface convex and set with short, transversely placed clusters of 4 to 5 long bristles; the distal margin of the merus is excavate; the first peduncular article is short, triangulate; the second article is twice as long as the first, slightly curved; the third article is three-fifths as long as the second and tapers to a curved, acuminate point.

The first legs have the merus irregularly suboval, four-fifths as wide as long, with clusters of stiff rugae set in short, broken grooves on the outer face. The carpus, propodus and dactyl are slender, cylindrical, tapering slightly distally; the carpus is three-fourths as long as the merus; the propodus and dactyl are subequal to the merus and to each other in length and both are abundantly set with transversely arranged clusters of long and short setae, those on the distal end of the dactyl forming a brush.

The second, third and fourth pairs of legs are falcate and successively decrease in size posteriorly; the second and third legs each have the propodus produced into a stout, curved, acute tooth that projects

and reinforces the dactyl, which is deeply concave on the outer lateral margin, with the tip rounded and both lateral margins setose; the fourth leg has the propodus less produced and the dactyl rather thick on the anterior lateral margin, tapering distally and forming a stocky triangle.

The fifth legs are quite long and slender and fold inside the branchial cavity; the ischium and merus are quite long, subequal; the carpus three-fourths as long as the merus; the propodus not quite as long as the carpus, slender, it and the dactyl forming a perfect small chelae, with a heavy brush of setae on each finger.

The present specimen is carrying about 300 small, spherical eggs, attached to the long, slender, ciliated abdominal appendages.

SYNONYMY.—*Hippa emerita* MILNE EDWARDS and LUCAS, Crust. in D'ORBIGNY'S Voy. Mer. Merid., vol. 6, p. 32, 1843; NICOLET, Crust. in Gay, Hist. Chile, vol. 3, p. 185, 1849.—DESAUSSURE, Rev. et Mag. Zoöl., vol. 5, p. 367, 1853 (not EDWARDS).

Hippa talpoides DANA, U. S. Explor. Exped., vol. 13, Crust., p. 409, pl. 25, fig. 10, 1852; Proc. Acad. Nat. Sci. Phila., vol. 7, p. 175, 1854 (not SAY).

Hippa analoga STIMPSON, Proc. Boston Soc. Nat. Hist., vol. 6, p. 486, 1857.—MIERS, Journ. Linn. Soc. London, Zoöl., vol. 14, p. 324, pl. 5, fig. 10, 1879.—ORTMANN, Zoöl. Jahrb. f. Syst., vol. 6, p. 537, pl. 26, fig. 1, 1892; HOLMES, Occas. Papers Calif. Acad. Sci., vol. 7, p. 103, 1900.

Emerita analoga RATHBUN, M. J., Harriman Alaska Exped., vol. 10, Crust., p. 168, 1904.—WEYMOUTH and RICHARDSON, Smiths. Misc. Coll., vol. 59, No. 7, 1812.—MEAD, Univ. Calif. Publ. in Zoöl., vol. 16, p. 431, 1917.—SCHMITT, *idem,* vol. 23, p. 173, fig. 19, 1921.

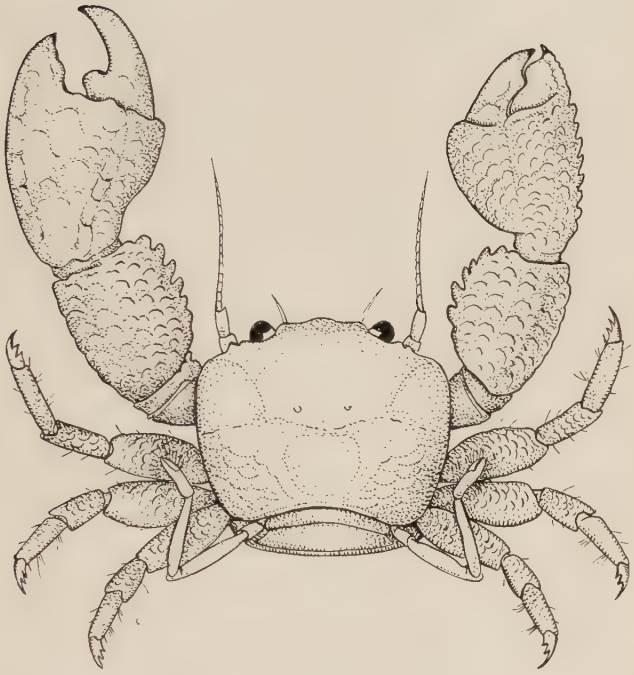
Family: PORCELLANIDAE.

Genus: PISOSOMA Stimpson.

Pisosoma angustifrons Benedict.

Plate 18.

DIAGNOSTIC CHARACTERS: Chelipeds unequal, the right being the larger; carpus evenly paved with granules; anterior margin with four teeth, the distal one of which is normally bifid; two prominent rows of granules on the palm. The carapace is wider than long, the anterior margin but little arcuate, the branchial regions roughened with transverse rugae.



Pisosoma angustifrons Benedict, ×5.

TYPE: The type was collected at Trinidad by the United States Bureau of Fisheries steamer *"Albatross"* and is deposited in the United States National Museum.

DISTRIBUTION: Hitherto known only from the type taken at Trinidad and eight specimens taken at Caracas Bay, Curaçao, in coral, *Meandra* and from between the roots of a Gorgonian. Thus the *"Ara"* material substantially extends the northern range of the species.

MATERIAL EXAMINED: Five specimens dredged in 20 fms., south of Sand Key, Key West, Florida, January 25, 1924, by the *"Ara."*

TECHNICAL DESCRIPTION: Carapace wider than long, 5.1 mm. wide, 4 mm. long, interorbital margin 2 mm. wide, frontal margin apparently straight in a dorsal view but actually produced in the median line to a little point and slightly concave on either side, when viewed from the under side. The preorbital angle is approximately right-angled and the postorbital angle is slightly obtuse, the acuminate tip bent down close between the eye and the antennal base. The anterolateral margin is only moderately arcuate, the branchial regions tumid, the sidewalls prominent, the posterior margin slightly sinuate and carinate. The dorsal surface is longitudinally convex; there are a pair of low, transverse elevations on the mesogastric region; the cervical groove is well defined, a line runs out onto the branchial region from the urogastric region; the hepatic and branchial regions, particularly on the posterior half, are covered by a series of coarse, transverse rugae. The abdomen is broad, with all the segments well developed; the first and second segments have the lateral margins tapering, rounded; the third, fourth and fifth segments have this margin relatively straight; the sixth segment is smaller than the fifth, with the postlateral margin excavate; the telson is rounded, with the basal section triangular, the remaining sections wedge-shaped, like four slices of pie, the suture between the proximal and distal pair of sections being nearly straight. The uropoda have the peduncular joint short and wide; the blades are nearly equal, elongate-ovate, but with the distal half slightly the wider; the margins are ciliated.

The eye has a very short stalk, only the calcareous edge of which shows; the cornea is spherical, large, completely filling the ocular cavity.

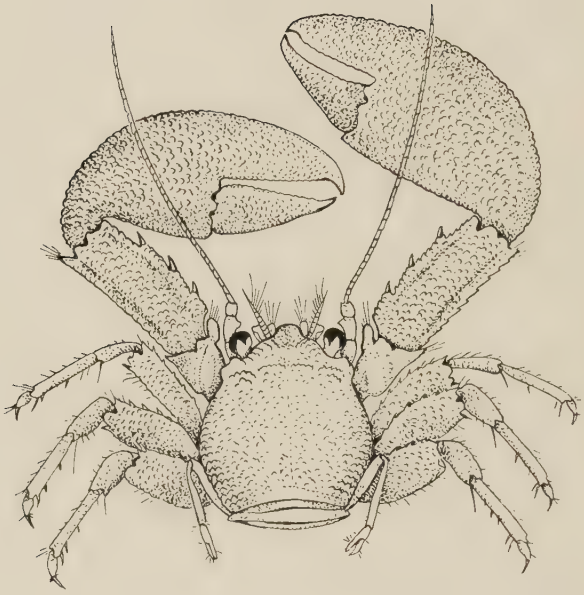
The antennulae are slender and fold transversely within the fossett beneath the frontal border.

The antennae have the peduncular joints stocky, cylindrical, the flagellum exceedingly ciliate, slender, extending as far as the finger of the extended great chelae.

The external maxillipeds have the ischium large, lobate, its inner lateral and distal margins convex; the merus about as long as the ischium but much narrower, with the inner lateral margin concave on either side of an almost median, rounded, triangulate node; the basal peduncular article is triangular on the outer face, grooved beneath, the second article is tapering and very setiferous, the third is smaller, more tapering and also furnished with a brush of very long, plumose setae.

The chelipeds are decidedly unequal, the right being the larger. The meral joint is small, appressed, with the inner lateral margins denticulate distally; the carpus is nearly as long as broad, with the outer surface convex and paved with coarse transversely placed, squamose rugae; the superior lateral margin is armed with four approximately equal, triangular teeth, the distal one of which is occasionally augmented by an enlarged granule basally, causing the tooth to appear bifid; the propodus is much enlarged, the palm a little more than the carpus, dilated distally, the finger short and thick, with a large, blunt, sub-basal tooth, followed by two or three smaller teeth, the tip triangular; both palm and lower finger are paved with coarse, rough, rounded granulae, which along the inferior margin form a double row. The hinged finger is curved, slenderer than the lower finger, with a large sub-basal and several smaller teeth; the outer surface squamose.

The second, third and fourth legs are similar, successively decreasing slightly in size posteriorly, all with the meral joint widened, its greatest width equal to quite half its length; suboval, the carpus little more than half as long as the merus, subcylindrical, but widening slightly distally, with the outer distal angle forming a blunt tooth, the inner distal angle less pronounced; the propodus is as long as the carpus, subcylindrical, armed on the inferior lateral margin with a row of three or four acute, forward-pointing spines; the dactyl is three-fourths as long as the propodus, smaller, with a very acuminate, curved, hook-like tooth at the apex and a row of three acute spines on the inferior lateral margin. The lateral margin of the merus, carpus and propodus is roughened, granulose and set sparsely with clusters of setae.



Petrolisthes armatus (Gibbes), ×2.

The fifth legs are characteristically small, with the merus and carpus elongated, slender, subequal, the propodus scarcely half the length of the carpus and with the dactyl forming a small weak chela, which is enveloped in a brush of outstanding setae.

SYNONYMY.—*Pisosoma angustifrons* BENEDICT, Bull. U. S. Fish. Comm., vol. 20, part 2, p. 135, pl. 3, fig. 6, 1901.—SCHMITT, Bijdragen tot de Dierkunde, Natura artis magistra te Amsterdam, Afl. 23, p. 74, 1924.

Genus: **PETROLISTHES** Stimpson.

Petrolisthes armatus (Gibbes).

Plate 19.

DIAGNOSTIC CHARACTERS: Carpus of chelipeds armed with three teeth on anterior margin; merus of first and second ambulatories with one subdistal spine on the posterior lateral margin; no such spine on the merus of the third ambulatory leg. Lateral margins of carapace terminating anteriorly in a sharp distal (or hepatic) spine.

TYPE: The type material was from Florida and was originally deposited in the Boston Society of Natural History and Charleston Museum, S. C.

DISTRIBUTION: The entire West Indian region; the Indo-Pacific region, and on the West American coast from Lower California to Peru, including the Galapagos Islands.

MATERIAL EXAMINED: One, Cape Cruz, Cuba, 3 fms., February 11, 1924, by the "Ara." One, Pigeon Key, Fla., April 17, 1923.

TECHNICAL DESCRIPTION: Carapace nearly as long as wide, moderately convex; surface covered with flattish, broken, transverse rugae, which are more prominent on the lateral branchial regions. Rostrum broadly triangular, with a distinct but shallow median depression; frontal margin slightly sinuate and finely crenulated; the superior orbital margin is unbroken. The lateral margins are carina-like and terminate sharply in a sharp postorbital spine. The hepatic sinus is shallow but distinct. The anterolateral or postorbital angle is almost right-angled. There are a pair of wide, transverse ridges slightly separated from each other by the median groove, which, taken together, form a prominent postrostral transverse groove across the anterior gastric region. The abdomen is composed of six segments, of which the anterior three are dorsally visible, the remaining segments being loosely flexed under the body. The first segment is but little

more than half as wide and long as the second and has its anterolateral margins narrowly rounded, its postlateral margins convergent. The second, third, fourth and fifth segments are subequal; each has its lateral margin separately rounded and heavily fringed with long, plumose setae; the sixth segment is narrower than the fifth and has its lateral process slender, narrow, acuminate, excavate for the reception of the peduncle of the rhipidura. The telson is subtriangular, with the lateral and posterior margins rounded; it consists of a short, proximal median triangular plate, which has the lateral contour sinuate, and a pair of lateral lobes, which surround and project beyond the median plate; each lateral lobe is traversed by a pair of sinuate sutures, which extend from opposite the inner distal margin inward to the suture around the median lobe. There is also a posterior pair of sutures, which extend inward a little obliquely to the median membranous area, which is just posterior to the apex of the median proximal plate; this median membranous area continues as a median line separating the lateral lobes; there is also a clear-cut median incision separating the convex margined lateral lobes. Thus the telson is composed of a proximal median plate, which is surrounded by two lateral lobes, each of which is broken by sutures into three parts, giving the telson the appearance of being composed of seven plates. The rhipidura have the peduncle broad and short, with its outer margin cut into three unequal lobes, of which the most anterior is small and acuminate; the median larger and subangulate; the posterior as large as the other two taken together and broadly rounded; the inner blade is longer and is elongate-oval, with its distal margin broadly rounded, finely crenulate and heavily fringed with long, plumose setae.

The chelipeds are slightly unequal, the left being the larger. Each cheliped is broad and flat, with the three proximal joints small, the merus short and broad distally, trigonal, with a single small spine on its posterior distal margin, also a small spine on its ventral anterior distal margin; there is also a subdistal, curved, transverse rugae on the dorsal surface of the merus; the carpus is three-fourths as long as the maximum width of the carapace and is trigonal, its upper surface being relatively flat and covered with small rugae; the anterior margin is armed with three teeth; the distal dorsal margin is sinuate, armed with two or three spines; the dorsal posterior lateral margin is accentuated by a longitudinal series of six or seven forward-pointing spines; the anterior lateral face of the carpus is slightly excavate,

so that the reflexed propodus fits closely into it; the posterior lateral face of the carpus is convex; the propodus is very large, being twice as long as the carpus, the palm comprising two-thirds of this length. The palm is triangular, widening distally; the outer surface is flat, covered with small, crimson rugae; the propodal finger is triangular, with the tip upcurved, the cutting edge slightly carinate and sinuate. The hinged finger is subequal to the propodal finger but has a decided submarginal groove paralleling its upper lateral margin. The left cheliped has its propodal finger narrower than that of the right cheliped and its hinged finger much broader basally. There is a distinct gape between the fingers of the left cheliped, the propodal finger also having a slight excavation near its distal end and its apex not upcurved; the tip of the hinged finger is curved and convex subdistally. The inner depressed area of the cutting edge of both the hinged fingers also the basal area of the propodal fingers are densely pilose; these hairs forming a short, velvety brush which is not visible in an external view of the chelipeds.

The first, second and third pairs of ambulatories are similar; the first and second pairs are subequal in length, the third being shorter, reaching only to midway the propodus of the second pair. Each leg has the merus broad, one-half as wide as long, with the anterior lateral margin armed with three or more spines and fringed with plumose setae; the posterior lateral margin of the first and second legs is armed with a sharp subdistal spine, which is absent on the third leg; the carpus is a little more than half as long as the merus and is much narrower; it is convex dorsally, widening a little distally, and the upper distal angle is roundly produced; the propodus is about as long as the carpus but is much slenderer and is produced distally on its posterior lateral margin into a rounded process, which reinforces the dactyl joint; the dactyl is slightly more than half as long as the propodus and is stout and curved with an acuminate tip. The four distal joints of these legs are well furnished with tufts of setae, also a few plumose setae.

The fifth pair of legs are characteristically small, slender, reflexed and chelate. The merus is very long, the carpus almost as long as the merus but slenderer and furnished with a brush of setae on the inner distal margin; the propodus is scarcely two-fifths as long as the carpus, and the subequal, spoon-shaped fingers comprise a third of this length; the propodus and closed fingers are cylindrical and covered with stiff setae; the apices of the fingers are broadly rounded.

The eyestalks are short, stout, constricted below the cornea and produced distally on the dorsal surface into a rounded process which projects onto the cornea; the cornea is large, elliptical.

SYNONYMY.—*Porcellana armata* GIBBES, Proc. American Assoc. Adv. Sci., vol. 3, p. 190, 1850.

Porcellana gundlachii GUÉRIN, in LA SAGRA'S Hist. Cuba, vol. 8, atlas, Articulata, pl. 2, fig. 6, 1855.

Petrolisthes armatus STIMPSON, Proc. Acad. Nat. Sci. Phila., vol. 10, p. 227, 1858; Ann. Lyc. Nat. Hist. New York, vol. VII, p. 73, 1860. —KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1879, p. 406.—ORTMANN, Zoöl. Jahrb., vol. X, p. 280, 1897.—RATHBUN, Ann. Inst. Jamaica, vol. 1, art. 1, p. 40, 1897.—BENEDICT, Rept. U. S. Comm. Fish., vol. 20, part 2, p. 133, 1901.—RATHBUN, Proc. U. S. Nat. Mus., vol. 38, p. 558, pl. 41, fig. 3, 1911.—VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 13, p. 434, 1908.

Petrolisthes galathinus (Bosc).

Plate 20.

TYPE: The locality of Bosc's type was unknown.

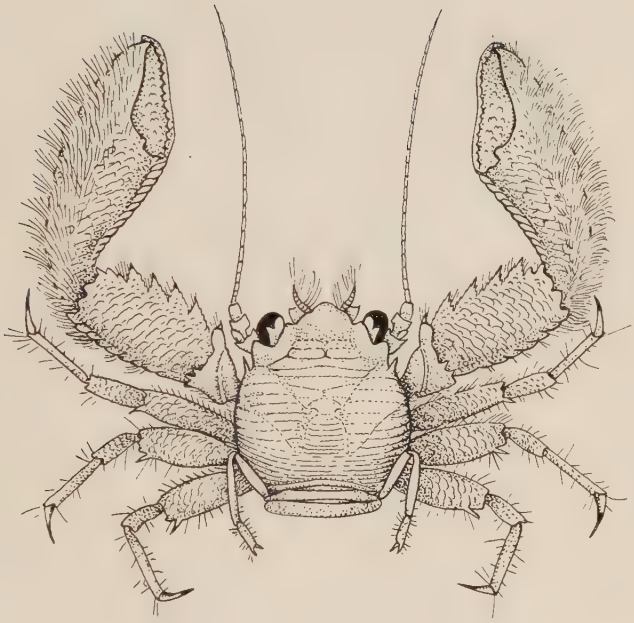
DISTRIBUTION: West Indian region; littoral.

MATERIAL EXAMINED: One specimen from Cualeo Reales, Cuba.

DIAGNOSTIC CHARACTERS: Carpus of chelipeds two-thirds as wide, including the marginal teeth, as it is long; a series of about six prominent rounded squamae form a median ridge on the dorsal surface; smaller granules are scattered on the remaining dorsal area; the posterior lateral margin is accentuated by a series of about six rugae, which are produced into upward- and forward-pointing spines, the distal one of which projects beyond the margin; the anterior lateral margin is cut into five acute jagged triangular teeth, which have their margin finely serrate.

Carapace convex in both directions; lateral margins delineated by a line which terminates anteriorly in a single, sharp hepatic spine. Dorsal surface of carapace devoid of rugae except for a pair of wide, transverse rugae on the anterior part of the gastric region, minutely, sparsely granulate and finely hirsute. Distal pair of sutures on the telson oblique.

TECHNICAL DESCRIPTION: Carapace as wide as long, convex in both directions; lateral margins delineated by a line which terminates anteriorly in a sharp hepatic spine. Rostrum two-fifths as wide as



Petrolisthes galathinus (Bosc), ×3.

the carapace, triangulate, apex produced, broad, lateral margins excavate, outer angles blunt, obtuse. Superior orbital margin unbroken, postorbital angles acute. There are a pair of wide, transverse rugae on the anterior part of the gastric region; the remainder of the carapace is devoid of rugae, minutely, sparsely granulate and finely hirsute; the cervical and cardiac regions are not areolated. There is a shallow depression on the rostrum. The abdomen has the proximal pair of sutures in the telson transverse and the distal pair of sutures oblique.

The eyestalk is very short, dorsally constricted and produced on the upper distal surface into an anterior rounded lobe followed by a triangular lobe which projects upon the cornea for about half of its depth.

The antennulae have the basal article greatly enlarged, lobate, with the external margin traversed by rugae and the inner half of the distal margin rounded, crenulate, the apex sharp at the inner orbital angle, the outer half of the distal margin also rounded; the next two joints are slender, cylindrical and fold within the antennal fossett; the flagellum is short, two-branched, hirsute. The distal margin of the basal joint is visible in a dorsal view as a rounded lobe between two small triangulate points. This projects on each side beyond the margin of the rostrum.

The antennae have the basal articles short, produced on its anterior distal angle into a small, dorsally concave, triangulate process which has the margins finely serrate and terminates anteriorly in a prominent, tooth-like apex; the second article is slightly longer than the first and is cylindrical; the third article is about half the size of the first; the flagellum is about two and one-half times as long as the carapace is wide, and consists of many annulations, each of which is about twice as long as wide and devoid of setae.

The external maxillipeds have the ischium of the endognath broadly rounded distally and somewhat widened at the external distal angle; there is no separate lobe on the ischium at the base of the merus; the merus is produced on its inner lateral margin in an acute triangulate process which extends inwards for two-thirds of the width of the ischium; the three-jointed palp is large and well furnished with long brushes of plumose setae.

The chelipeds are slightly unequal; the merus is roughened on its dorsal surface by a few spiny rugae and produced on its anterior dorsal angle into a prominent, acute, triangulate tooth, which is sub-

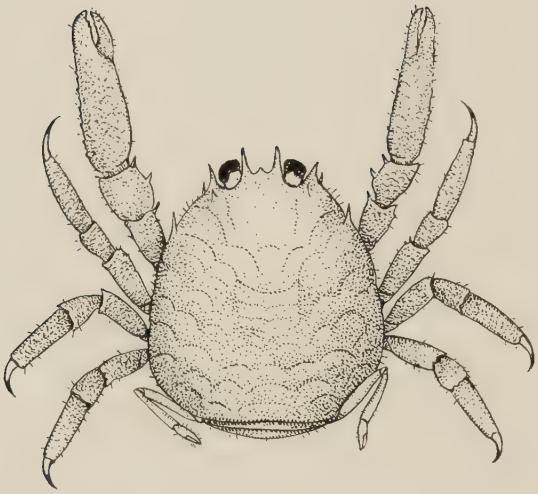
equal to those on the anterior margin of the carpus, and has its margin finely serrate; the carpus is equal to six-tenths of the width of the carapace, and is two-thirds as wide as its own length; it has the anterior lateral margin cut into five acute, jagged, triangular teeth, which have their margins finely serrate; the posterior lateral margin is accentuated by a series of about six rugae, which are produced into upward- and forward-pointing spines, the distal one of which projects beyond the margin; a series of about six prominent, rounded squamae form a median ridge on the dorsal surface; smaller granules are scattered on the remaining dorsal area; the distal carpal margin is sinuate; the propodus is triangulate, nearly twice as long as the carpus, decidedly flattened, with the lower margin beaded with a series of small rugae, each of which is produced into an acute, outward-pointing spine; there is a prominent row of low, rounded squamae extending from the upper proximal angle of the propodus to the tip of the hinged finger; the upper lateral margin of the palm is carinate, and its distal angle is an acuminate tooth; the upper lateral margin of the hinged finger is subequal to that of the propodus, close-fitting, the cutting edges concave, the tips curved. There is a sparse pilosity in the inner hiatus of the hinged finger.

The first three ambulatories are subequal. Each has the merus greatly expanded, three-fifths as wide as long, or equal in length to the carpus of the cheliped and with the lateral margins convex, convergent proximally and distally; the dorsal surface crossed by transverse rugae, sparsely setiferous; the posterior distal angle of the first and second pairs of ambulatories with a subdistal spine; on the third pair of legs this spine is absent; the carpus is about half as long as the merus but much slenderer; the propodus is similar to but a third longer than the carpus and has its distal lateral margins produced into rounded plates, which reinforce the dactyl; the dactyl is half as long as the propodus, stout basally, with a strong curved tip; the carpus, propodus and dactyl are sparsely furnished with long, stiff setae. There is a longitudinal series of small, sharp spines on the ventral margin of the propodus and dactyl.

The fifth legs are typically small and slender, offering no specific characters.

Synonymy.—*Porcellana galathina* L. A. G. Bosc (not Say), Hist. Nat. Crust., vol. 1, p. 233, pl. 6, fig. 2, 1802.

Porcellana sexspinosa L. R. Gibbes, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 190, 1850.



Porcellana rosamondae Boone, type, ×6.

Porcellana boscii J. D. Dana, U. S. Explor. Exped., vol. 13, pt. 1, p. 421, pl. 26, fig. 11, 1852.

Porcellana danae L. R. Gibbes, Proc. Elliott Soc. Nat. Hist., vol. 1, p. 11, 1854.

Porcellana egregia Guérin-Meneville, Crust. Hist. Cuba, p. 39, pl. 2, fig. 1, 1857.

Petrolisthes brasiliensis S. I. Smith, Trans. Conn. Arts and Sci., vol. 2, p. 38, 1869.

Petrolisthes galathinus A. E. Ortmann, Zoöl. Jahrb. Syst., vol. 10, p. 283, 1897.—C. Moreira, Arch. Mus. Nac. (Brazil), vol. 11, p. 93, 1901.—A. Milne Edwards and Bouvier, Mem. Mus. Comp. Zoöl., vol. 47, p. 289, pl. 1, figs. 1, 2, 1923.

Petrolisthes sexspinosus Benedict, Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 133, 1901.

Genus: **PORCELLANA** Lamarck, restricted, Stimpson, 1907.

Porcellana rosamondae, new species.

Plate 21.

Name: I take pleasure in naming this little crab in honor of Mrs. William K. Vanderbilt (Rosamond L. Vanderbilt), a member of the *"Ara"* Expedition, 1928.

Type: Founded on one specimen, dredged in Limon Bay, Panama, January, 1928, by the *"Ara."*

Distribution: Known only from the type locality.

Material examined: The type.

Technical description: Carapace 4.4 mm. long, 3.4 mm. wide across the middle region. Carapace convex in both directions; much the wider on the posterior portion, narrowing anteriorly. Frontal region narrowed, with a short, inconspicuous median tooth depressed, on each side of which and separated by a shallow, U-shaped sinus there is a strong prominent, acute preorbital tooth which projects a little farther forward than the eye. The postorbital tooth is very similar to the preorbital tooth but not quite as long. There is also a strong, acute hepatic tooth, behind which the lateral carina curves around the margin of the carapace. The cardiac region is definitely circumscribed, but is also crossed by two transverse striae, not unlike those on the remainder of the dorsal surface of the carapace. There are numerous fine, transverse striae forming arcuate lines across the cara-

pace; those on the mesogastric region smaller and more broken. The paired submedian lines of the telson are transverse, almost straight. The chelipeds are of moderate size; the merus short, appressed to the body, a spine at the inner, upper distal angle; the carpus is about as long and as wide as the merus, subcylindrical, with a spine midway the inner lateral margin, and another spine at the inner distal angle. The propodus is nearly three times as long as the carpus, the palm being two-thirds of this width, the fingers comprising the remaining third. The propodus is of no greater width than the carpus, with the outer face moderately convex; both the carpus and the propodus have the outer faces crossed by small striae similar to those on the carapace. The fingers are similar, straight, meeting throughout their entire length, neither with a large tooth. In the type, the left cheliped is distinctly larger than the right, but this is very obviously the result of an accident to and the regeneration of the right claw.

The second, third and fourth pairs of legs are similar, slender, each with the propodus elongated, the dactyl scarcely half as long, very curved and acuminate.

The fifth legs are small, slender, weakly chelate, reflexed in the usual manner.

The type is a female, carrying about thirty spherical eggs; the eye-spots showing in the embryos.

MACRURA.

Family: SCYLLARIDAE.

Genus: SCYLLARIDES Gill.

Scyllarides aequinoctalis (Lund) Gill.

Plate 22.

TYPE: Lund's type came from the Antilles and is deposited in the Copenhagen Museum.

DISTRIBUTION: Littoral in the West Indian region; depths ranging from tide-line to 100 fathoms.

COLOR: See Verrill for extensive notes on this animal.

HABITS: See Boone and Verrill.

ECONOMIC USES: Sold as a food among the Spanish natives of the West Indies but seldom used by the English-speaking peoples. Also used by the fishermen as a bait for capturing the spiny lobster.

Scyllarides aequinoctalis (Lund) Gill, about one-half natural size.

MATERIAL EXAMINED: One large specimen taken in the Bay Biscayne, Florida, 1923, field tag 208.

TECHNICAL DESCRIPTION: Carapace oblong, nearly squarish, about three-eighths of an inch wider than long, exclusive of prefrontal segment; with the median region much elevated, sloping towards the frontal and lateral margins. The entire dorsal surface is paved with coarse, flattish, irregular granules, from which arise very fine cilia. Ciliae are also found sparsely in the interspaces between the granules. These granules form small serrations along the frontal margin and also on the anterior part of the lateral margins; in front of the cervical notch are about ten more sharply defined serrations. The lateral margins are approximately subparallel for the greater part of their length, except that posteriorly they are slightly convergent with the postlateral angles rounded. Anterior to the posterior margin there is a slightly arcuate transverse groove across the greater width of the carapace but not reaching the lateral margins. The cervical, cardiac and urogastric grooves are clearly delineated; there is a well marked depression at the outer curve of the cervical groove behind the orbit; another pair of depressions between the cardiac and intestinal regions. The rostrum is coarsely granulated, slightly bilobed with a pair of submedian, pointed teeth, each one confluent on the outer side with the rounded anterolateral margins.

The orbits are prominent, especially the superior inner orbital angle and, a little less so, the inferior angle. The entire orbital margin is crenulated. The eyestalks are stocky, nearly as wide as long, constricted below the cornea, which is rather small. In life it is said to be conspicuously striped longitudinally.

The antennulae have the basal joint clavate, spinulose at each the upper and lower distal angles; the second joint about as long as the first but much slenderer; the third article is subequal in length to the second but is much slenderer; the flagellum has the slenderer inner whip as long as the third joint, and the outer whip is three-fourths as long as the inner one.

The antennae have the basal segment short, the outer distal angle granulated or toothed and the inner distal superior angle produced into a lobe which almost surrounds the anterior margin of the rostrum and which is cut into three, occasionally four, prominent, divergent, obtuse teeth on the anterior margin; the second antennal joint is wider proximally than long, with the inner lateral margin of the proximal

part slightly bent upward and with two prominent, acute teeth; the outer lateral margin is rounded and crenulate, one or two tooth-like tubercles appearing more prominent than the others; the distal margin is nearly at right angles to the outer lateral margin, a strong tooth marking their union; a lesser tooth marks the inner distal angle and inside this there are one or two other serrations. The entire upper surface of the second segment is coarsely granulate, especially on the proximal portion; the third segment, which is very small, fits into the excavation above the proximal inner portion of the second segment and has the inner lateral margin rounded, and the distal angle forms a prominent tooth; the distal segment of the antennae is wider than long, with the frontolateral margin broadly rounded and crenulated by the coarse granules which pave the upper surface.

The abdomen has the first segment short and less wide than the succeeding segments, with the lateral region more coarsely granulate and rounded, one or two teeth. The second segment is twice as long as the first, with a transverse constriction near the anterior margin, the remainder of the segment convex, slightly humped in the median region, the lateral margin prominently rounded and crenulated with about 15 teeth, those teeth on the anterior half being the larger; there is a distinct V-like groove on the epimeral region, the posterior margin is fringed with very fine cilia. The third segment is as long in the median line as the second, with the hump more accentuated and the epimeral margin much narrower, granulated, overlapped proximally on the anterior margin by the epimera of the second segment, the lateral margin truncated and dentated; the fourth segment is similar to the third segment, but a trifle longer in the median line, with the epimeral region narrower than the third. The fifth segment is scarcely three-fourths as long as the fourth, with the anterior margin quite arcuate, the median hump less pronounced, the lateral region very narrowed, granulose, margin dentated. The sixth segment is about as long as the fifth in the median line, less wide, being excavate at the base of the uropod. There is a pattern formed by three transverse lines among the paved granules of this segment, one line being arcuate near the median anterior margin, the other two forming a pair of transverse lines, one on either side of the segment. The telson is wider than long, granulose and setose, the proximal portion more so, five-lobed, the thinner distal margin with radiating fine riblets, the laterodistal margins broadly rounded.

The peduncle of the uropod is small, strong, the dorsal surface granulose, a median triangular point distally; the blades are large, four-fifths as wide as long, with the outer lateral margin broadly rounded, the distal margin nearly truncate and the inner lateral margin nearly straight. The proximal part of each blade is thickened and very granulose; the remaining part is covered by numerous fine, radiating riblets set with fine, stiff setae.

The external maxillipeds are relatively small but fill the buccal cavity; the ischium is as long as that of the endognath, slender, rod-like on the inner side, with a convex-margined, leaf-like expansion on the outer side, which fits beneath the margin of the buccal cavity; the whip is slender, setiferous on its outer margin, fitting under the tooth-like projection of the anterior angle of the buccal cavern. The ischium of the endognath is nearly as wide as long, with the outer distal angle slightly accentuated; the merus is not much smaller than the ischium but narrow distally; there is a longitudinal sulcus on both articles near the outer margin; the proximal part of the ischium is much more roughly granulose than the balance of the outer surface of the maxilliped. The triarticulate palp is stocky, the second joint being the longest of the series, the three joints folding inside the proximal articles and being nearly as long as they.

The sternal plastron bears an arched ridge, terminating at each end in a ventrally directed tubercle between each pair of legs.

The seven pairs of legs are each monodactyl.

Synonymy.—*Scyllarus aequinoctalis* Lund, Skrivter af Naturhistorie-Selskabet, Copenhagen, II (2), p. 21, 1793.—Fabricius, Suppl. Entom. Syst., p. 399, 1798.—Bosc, Crustacea, vol. 2, p. 19, 1802.—H. Milne Edwards, Hist. Nat. Crust., vol. 2, p. 285, pl. 24, fig. 6, 1837.—Gibbes, Proc. Acad. Nat. Sci. Phila., 1850, p. 193.—S. I. Smith, Trans. Conn. Acad. Sci., vol. 2, p. 18, p. 39, 1869 (detailed description).—Rankin, Ann. N. Y. Acad. Sci., vol. 12, p. 535, 1869.

Scyllarides aequinoctalis Gill, Science, new series, vol. 7, p. 99, 1898.—Rathbun, Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 97, 1901.—A. E. Verrill, Trans. Conn. Acad. Arts and Sci., vol. 12, p. 535, 1869.—Boone, Bull. Bingham Oceanog. Coll., vol. 1, part 2, p. 88, 1927.

Genus: **SCYLLARUS** Linné.

Scyllarus americanus S. I. Smith.

Plate 23, fig. A.

TYPE: Founded on several specimens collected on Egmont Key, west coast of Florida and deposited in

DISTRIBUTION: Known from *"Blake"* station 142, Flannegan Passage, and Egmont Key, Florida, Sands Key, Florida; Cuba, 45 fms., the Caribbean Sea and Brazil.

MATERIAL EXAMINED: Two specimens taken in dragnet, off Knight's Key, Florida, March 29, 1926; one specimen from Marquesas Keys, Fla., 70 fms., collected by the *"Ara,"* William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Animal 67 mm. long, including antennae. Carapace squarish, about 1 mm. longer than wide, with the median dorsal line ridged and much elevated, broken into three tooth-like processes, the median of which is the largest. The cervical groove is well defined. There is also a pronounced ridge running backward from the inner orbital angle, with two teeth above the eye and interrupted by the transverse cervical groove. The median and orbital ridges are covered with squamiform tubercles, which are also present in a less pronounced degree in the wide, concave sulci which lie on either side of the median ridge, between it and the orbital ridges, the sulci being wider anteriorly. The lateral margin is covered with squamosities and marked by four flat teeth anterior to the incision of the cervical groove and one similar tooth posterior to it. There is a transverse flat carina along the median three-fifths of the posterior margin and a slight median emargination in the posterior margin. The frontal margin of the carapace is truncate, shallowly emarginate in the median region produced to a nodular lobe in advance of the orbital ridge from which it is separated by a sinus. The orbital margin is closed, except for two incisions anteriorly, separated from each other by a triangular node which lies anteriorly at the base of the longitudinal ridge of the proximal article of the antennae.

The antennulae lie between the large spatulate antennae and have the peduncular article thickened, about two and one-third times as long as wide; the upper surface is flat and truncated obliquely distally; the second article is about one-fifth longer than the first article, slender and cylindrical; the third article is similar to the second but

A

B

A.—*Scyllarus americanus* S. I. Smith, natural size. B.—*Polycheles sculptus* S. I. Smith, young, × 2.

only three-fourths as long and bears the two-branched flagellum, the slenderer, longer branch of which consists of 15 annulations, tipped with a tuft of setae, and is about equal in length to the third peduncular article; the thicker branch of the flagellum is only three-fourths as long as the other branch but consists of 15 very short annulations, which all bear distally on their inferior side a dense brush of setae.

The basal antennal article is short and only visible dorsally as a node at the inner distal angle; the second article is broadly lobate, its dorsal surface marked by a slightly oblique longitudinal carina, which extends to the tip of the apical tooth. There are two sharply incised triangular teeth on the outer convex margin of this article and three similar but smaller teeth on the inner lateral margin in addition to the basal tooth, which is separated from the other three by a concave ridge. There is a deep sulcus on the inner half of this article between the median ridge and lateral margin; the third article is small and narrow, forming a basal articulation for the wide, fan-like, broadly rounded distal lobe which is cut marginally into five broadly rounded, truncate teeth or lobes, the outermost of which is the widest, and a sixth, smaller, triangulate tooth on the inner lateral margin. The entire dorsal surface of the antennae is covered with stocky clavate setae, which also fringe the margin.

The eye is small, the stalk cylindrical, calcareous, constricted below the cornea and produced into a tongue-like process projecting on the upper surface of the cornea.

The sixth abdominal segments and the proximal two-fifths of the telson are covered with a definite pattern formed by squamous tubercles, each of which is fringed along the posterior margin by short setae. On the first two fourth segments, inclusive, there are transverse setae. The posterior margin of each of these segments is slightly notched in the median line. The second, third and fourth segments are marked by a blunt median dorsal ridge. The first segment is not so wide as the others and has its lateral margin rounded. The second to fifth segments have their margins lobate, slightly pointed. The base of the uropoda is promixally covered with squamae. The distal three-fifths of the telson and caudal fan is covered by fine radiating striae.

The five pairs of legs are monodactyl, the first pair much shorter and stockier than the other; all with acute, hook-like dactyli. The second pair are the longest, the third, fourth and fifth pairs decreasing slightly in length.

SYNONYMY.—*Arctus americanus* S. I. SMITH, Amer. Journ. Sci., ser. 2, vol. 48, p. 119, 1869; Ann. Mag. Nat. Hist., ser. 4, vol. 4, p. 229, 1872.—A. E. ORTMANN, Zoöl. Jahrb. Syst., vol. 10, p. 270, 1897.—RATHBUN, Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 97, 1901.

Scyllarus gundlachi E. VON MARTENS, Arch. Naturg., vol. 38, pt. 1, p. 123, pl. 5, fig. 3, 1872.

Scyllarus americanus E. L. BOUVIER, Results Camp. Sci. Monaco, vol. 50, p. 106, 1917; Mem. Mus. Comp. Zoöl., vol. 47, No. 5, p. 447, text fig. 14, 16, pl. 7, fig. 3, 1925.

Family: ERYONIDAE.

Genus: **POLYCHELES** C. Heller.

Polycheles sculptus S. I. Smith.

Plate 23, fig. B.

TYPE: Prof. Smith's type was collected in 250 fms., off the coast of Nova Scotia, S. E. of Sable Island, Lat. 43° 10′ N., Long. 61° 20′ W., by Capt. Thomas Olsen, of the schooner *"Espes Tarr"* and deposited in the United States National Museum.

DISTRIBUTION: This curious blind, claw-footed relic of the ancient Triassic Seas is known from the depth of the Atlantic on both sides, having been recorded from Nova Scotia, the east coast of the United States, the Antilles; from off the British Isles, the Cape Verde Islands, the Azores, the Mediterranean Sea, and the Cape of Good Hope.

MATERIAL EXAMINED: One very young specimen, dredged in 1100 fms., off Miami, Fla., March 3, 1926, by the *"Ara."*

COLOR: See Bouvier's exquisite color-plate. This shows the animal to be a delicate semitranslucent old ivory, with the body-spines, tail-fan, antennae and legs delicately tinged with rose, the setae golden.

DISCUSSION: Briefly characterized, this species may be distinguished from the other Atlantic species by the presence of a pair of rostral spines; the median dorsal carina bears, in addition to these rostral spines, the following: precervical, 2, 1, 2; postcervical, 2, 2, 2; the posterior marginal carina is armed with a pair of larger submedian spines situated at the posterior extremity of the dorsal carina. The inner orbital angle bears one spine. For full description of this species see Smith's description, also Bouvier; and Boone (Arcturus Expedition).

This curious species affords the carcinologist opportunity for the study of one of the most remarkably primitive crustaceans known.

Panulirus laevicauda Latreille, about two-fifths of natural size.

Its mouthparts and gill structures present an astonishing phase of Decapod evolution.

The "*Ara*" specimen is one of the youngest on record and is in excellent condition.

SYNONYMY.—*Polycheles sculptus* S. I. SMITH, Proc. U. S. Nat. Mus., vol. II, p. 269, 1880.—E. L. BOUVIER, Res. Campag. Sci., Monaco, Fasc. L., p. 51, pl. III, fig. 1 (colored), 1917 (with full synonymy).

Family: **PALINURIDAE.**

Genus: **PANULIRUS** J. E. Gray.

Panulirus laevicauda Latreille.

Plate 24.

DIAGNOSTIC CHARACTERS: This species is readily distinguished from its American allies by: (1) its distinctive, exquisitely rich moss green and maroon coloration; (2) the short proximal joint of the antennulae; (3) the shape of the epistome, particularly the anterior margin of the latter; (4) the fact that its abdominal segments are smooth dorsally, not having a transverse groove.

TYPE: Latreille's type came from "the shores of Brazil" and is deposited in the National Museum d'Historie Naturelle, Paris.

DISTRIBUTION: This species is abundant in Brazil and is commonly sold in the markets of that country. It has also been reported from French Guiana, one or two stations along the east coast of Central America and more rarely from the Isle of Pines and southern Cuba and Florida at Key West and Bay Biscayne.

MATERIAL EXAMINED: One specimen taken in the Bay Biscayne, near Miami, Florida, January, 1923, by the "*Ara,*" William K. Vanderbilt, commanding.

COLOR: The carapace is maroon, the spines of the carapace are green with a purplish-maroon base, except those on the lateral margin, which are set in a light creamy buff base. Orbital spines purple, mottled with light creamy buff; the convex ridge below the orbital spines is yellow anteriorly, shading into deep orange posteriorly.

The antennal peduncle is maroon, mottled sparsely with creamy buff. The spines have the basal half deeper maroon than elsewhere, ringed medially with cream, the distal half green. The flagellum is lighter purple, streaked ventrally and dorsally with a median longitudinal darker line.

The antennulae are maroon, with a creamy buff mottling at the distal end of each peduncular joint.

The legs have the first four joints maroon, with a slight greenish cast, longitudinally striated with narrow creamy lines slightly tinted with ochre, the fifth and sixth joints are a rich moss green longitudinally striated with narrow creamy lines.

The first abdominal somite has the anterior part green, mottled with whitish dots, the posterior part maroon, finely punctate, the second to fifth somites, inclusive, are maroon in the median area, shading into deeper maroon posteriorly, the lateral parts are green, the entire surface is finely punctate; a row of minute white dots parallel the posterior margin of each somite. The sides of the somite are maroon-greenish; there is an enlarged white spot on the median lateral region at the terminal of the epimeral groove; below these are many spots of creamy buff, including the tips of the segments. The telson has the basal part of the anterior third of the caudal fan green, spotted with creamy buff; the posterior third of the fan is a similar green, the interspace being a lighter green; the caudal fan is margined with bright yellow. All the pleopoda are green, dotted with a few creamy spots and bordered with a bright yellow margin.

TECHNICAL DESCRIPTION: Carapace about as long as the abdominal segments, including the anterior third of the caudal fan, covered with stout spines, the more prominent of which are arranged in ten more or less regular longitudinal rows; spaces between the major spines are almost completely covered with lesser spines, which are broader basally, sharp-tipped and ringed with a circle of close-set, plumose setae; all the spines are directed upward and forward. The side plates of the carapace are more freely articulate than in *P. argus* or *P. guttatus.*

Orbital spines compressed laterally, but less so than those of *Panulirus argus* or *P. guttatus,* deeper dorsoventrally, and slightly more elevated than in *argus* or *guttatus.* Eyes prominent, shining black. Anterior to the frontal horns there are four long, equal and equally spaced green spines; between the latter, near the base of the second pair, are several weak spines clothed with setae. There is a convex ridge extending from the base of the orbital spines to the extreme frontal margin; this is much more prominent than in *argus* or *guttatus.*

The antennae have the basal ridge short on the outer dorsal surface, produced and tapering to an acute point on the inner dorsal surface, also on the inner ventral surface; there is a very strong spine on the

inner dorsal angle of this point, another about half as strong on the outer dorsal angle; below the latter are two very minute spines. The inner posterior dorsal part of the basal joint is produced into a convex-concave triarticulate scale that slides over, forming the animal's sound-producing organ. The second joint of the antennae is about one and one-half times as long as the first and less oblique distally, but with a strong spine on the inner distal margin preceded by two less strong; there is another strong spine in the median dorsal area of the margin with two lesser spines just preceding it, and another weak spine on the outer lateral margin; there are several small spines on the outer lateral and ventral surfaces; the third article is almost as long as the second, almost evenly produced distally, with a series of three strong, subequal spines on the inner lateroventral margin, another strong spine on the median dorsal area of the margin, another similar spine on the outer lateral margin; there are seven or eight lesser spines scattered over the surface of the third article; the flagellum is about twice as long as the body and consists of slender, uniformly tapering rings; the flagellum is set with somewhat regularly placed rings of small spines at intervals and fringed along the proximal part on the inner ventral margin with fine, close-set setae.

The antennulae have the basal joint extending a trifle beyond the tip of the second peduncular joint of the antennae; the second article is two-thirds as long as the first and extends to the distal end of the peduncle of the antennae; the third article is a trifle shorter and slenderer than the second; the inner flagellum is longer and stouter than the outer, and is about a third as long as the flagellum of the antennae; the outer flagellum of the antennulae is a little more than half as long as the inner.

The epistome is shield-shaped, produced to a decided spine at the apex between the base of the antennulae; there is another spine on each side at the outer margin of the antennulae; the space between these spines is deeply, concavely excavate; the anterolateral margin of the epistome slopes abruptly diagonally from these spines to the outer lateral angle of the base of the antennae.

The exopodites of the first pair of maxillipeds are normal with brushes. The second maxillipeds have the exopodite well developed, multiarticulate, with brushes. The third maxillipeds have the exopodites very poorly developed.

The sternal plastron is decidedly shorter and broader than those of *P. argus* and *P. guttatus,* anteriorly it terminates in a blunt, rounded

nodule; the sterna corresponding to the first pair of appendages is roughly triangular and bears a deep groove in the median line; the sterna corresponding to the second, third and fourth pairs of limbs are similar in shape but graduatingly increase in width posteriorly, the fourth being widest. The sutures between all the sterna are distinct, those of the second to fourth sterna, inclusive, extend inward slightly more than half the distance to the median line; that of the fifth sterna extends farther in, almost to the median line; its apex is distinctly punctate.

The first pair of legs are stout; the second are longer and slenderer; the third are the longest; the fourth are about the same as the second; the fifth are the shortest and weakest; all have the dactyl stout, acute, and furnished with bristles on the first, second and third legs, and with slender spines interspersed with bristles on the fourth and fifth legs.

The first abdominal somite is short, decidedly grooved; the second and third somites are the longest, subequal; the fourth somite is about four-fifths as long as the third; the fifth somite is about four-fifths as long as the fourth; the posterior of each somite is fringed with short, close-set setae. The lateral angles of the somites are produced into acute teeth directed posteriorly; that of the first segment is most acute; those of the second and third are broader; of the fourth and fifth more curved; of the sixth broadly curved, less acute; the post-lateral margins of all the somites are finely serrate just above the apical tooth, while in *P. argus* there is a single spine, and also the same in *P. guttatus* but slightly differently placed. Pleopoda are wanting on the first abdominal segment; those of the second segment consist of a single broad, ovate, membranous lamina; the pleopoda of the third segment are about one and one-half times as long as those of the second and narrower; those of the fourth segment are slightly longer than those of the third, while those of the fifth segment are smaller and more acuminate.

Synonymy.—*Palinurus laevicauda* Latreille, Nouv. Dict. d'Hist. Nat., t. XVII, p. 295, 1803-04.—Desmarest, Consid. sur les Crust., p. 185, 1825.—H. Milne Edwards, Hist. Nat. Crust., vol. II, p. 30i, 1837.

?Panulirus inermis Pocock (young specimens), Journ. Linn. Soc. Zoöl., London, t. XX, p. —, 1890.

Panulirus ornatus Pocock and various other authors have confused *P. laevicauda* under this name.

Panulirus argus Latreille, reduced to about one-third of natural size.

Panulirus laevicauda Moreira, Archiv. Mus. Nat. Rio de Janeiro, vol. XI, p. 17, 1901.—A. Gruvel, Ann. l'Institut Oceanographique, Monaco, t. III, p. 45, text fig. 21, 1912.—Boone, Proc. Biol. Soc. Washington, vol. 35, pp. 137-140, 1922.

Panulirus argus Latreille.

Plate 25.

Type: The type came from the Antilles and is deposited in the Paris Museum.

Distribution: Southern Florida, throughout the Gulf of Mexico and West Indies to the northern coast of South America, as far down as the mouth of the Amazon. Rare in Brazilian waters.

Material examined: One very large and one medium-size adult from the Bay Biscayne, Fla., March, 1923. One average-size and one small adult from Miami, Fla., 1923. One fairly large specimen from Miami, Fla., 1924.

Color: Very variable. The more common color type has the carapace mottled dark green and gray, becoming lighter on the sides; the abdomen is deep sea green, with the series of large, round, lateral spots of yellow or cream. The tail is lighter green, with bands of pale green and purplish black, the margin lighter, eyes black. Antennae bluish-green with purplish tints. Under side of lobster bluish white.

Technical description: Animal large, commonly with a body length of 8 to 12 inches (exclusive of antennae); weight of one to two pounds; unusual records exist of specimens weighing 10 to 25 pounds. Carapace robust, about as long as the abdomen exclusive of the telson; with the cervical suture deep, the preorbital or rostral horns very sharp, long, curved and much compressed laterally. The entire carapace is much more abundantly covered with spines than is that of *P. guttatus* or *P. laevicauda.* The preorbital or rostral horns of *P. argus* are much longer and sharper in proportion to its postorbital and antennal spines than are those of the other two West Indian species. The posterior margin of the carapace has a smooth carina with both margins ciliated, a narrow groove just anterior to the carapace. Each of the six abdominal segments has a distinct transverse groove; the epimeral margin of each plate is produced into an acute, posteriorly directed spine or tooth, and the second to sixth segments, inclusive, each have a small tooth at the postlateral angle; the posterior margin

of the sixth segment is denticulate; the caudal fan is much like that of *P. guttatus.*

The eyes are large; the stalk constricted just below the cornea.

The antennular segment is ornamented with a pair of submedian spines on its distal margin and a second pair behind the first pair, about midway the length of the segment.

The antennulae are smooth and have the first articles slender, elongated, cylindrical; the second and third articles short, subequal, the two considered together about as long as the first article; the whips slightly unequal, the thicker the shorter, but a little longer than the entire peduncle.

The antennae have the peduncular articles much thicker proximally than those of *guttatus;* the upper and outer surfaces of all three articles covered with stout, sharp, forward-directed spines; the whips are thick, tapering, setose, about one and one-third to one and one-half times as long as the body.

The five pairs of legs are each monodactyl, the dactyl tufted with short, stubby bristles.

SYNONYMY.—*Palinurus argus* LATREILLE, Ann. Mus. Hist. Nat. Paris., vol. 3, p. 593, 1804; Nouv. Dict. Hist. Nat., vol. XVII, p. 296.—OLIVIÉR, Encycl. Méth., vol. VIII, p. 663, 1811.—LAMARCK, Hist. des Anim. sans Vert., vol. V, p. 210, 1815.—DESMAREST, Consid. gen. sur les Crust., p. 185, 1825.—H. MILNE EDWARDS, Hist. Nat. Crust., vol. II, p. 300, 1834.—HELLER, Reise Freg. Novarra, Crust., p. 95, 1865 (Analytical table).—M. J. RATHBUN, Ann. Inst. Jamaica, vol. 1, art. 1, p. 44, 1897; Rapport Betreffende een voorloopig onderzoek naarden tostand van de visscherij, Kolonie Curaçao, 1907, p. 326.

Panulirus argus WHITE, List Crust. Brit. Mus., p. 69, 1847.—SMITH, Trans. Conn. Acad. Arts and Sci., vol. 2, p. 39, 1869.—RANKIN, Ann. N. Y. Zoöl. Soc., vol. XI, p. 536, 1900.—SPENCE BATE, Rept. Voy. *"Challenger,"* Macrura, vol. 24, p. 76, 1888.—M. J. RATHBUN, Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 98, 1901.—VERRILL, Trans. Conn. Acad. Arts and Sci., vol. XI, p. 705, fig. 56, and pl. XCIV, fig. 1, 1902; The Bermuda Islands, vol. 1, p. 293, fig. 56, pl. XCIV, fig. 1, 1902 (habits and life history).—VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 7, pl. 1, fig. 1, pl. 2, figs. 1 and 2; pl. 3, figs. 1 and 2, pl. 3A, figs. 2-6, pl. 8, figs. 2, 2a, pl. 9, fig. 1, also text fig. 1, 1922.

Panulirus guttatus (Latreille), greatly reduced.

Palinurus americana Stone, in Heilprin, The Bermuda Islands, p. 149.—Gruvel, Compt. Rend. Acad. Sci., vol. 152, 1911, p. 1351.—E. L. Bouvier, Mem. Mus. Comp. Zoöl., vol. 48, No. 5, p. 441, 1925.

Panulirus guttatus (Latreille).

Plate 26.

Type: The type was from the Antilles and is deposited in the Paris Museum.

Distribution: Littoral in the West Indian region. Less abundant in Florida and the upper West Indies than *P. argus,* but present in sufficient numbers to be of economic importance. Rather rare in Brazilian waters.

Color: The animal is a deep coppery brown, shaded with olivaceous green and irregularly maculated with round, creamy spots of varying sizes, the similarity of its markings to that of the barnyard "Guinea hen" giving rise to the common name "Guinea lobster."

Material examined: One very large specimen taken in trap, at Miami, Florida, 1923, by the *"Ara."*

Technical description: Animal large, commonly weighing from one to two pounds; exceptional records exist of specimens weighing ten pounds or more.

Carapace about as long as the abdominal segments exclusive of the caudal fan. Cervical groove deep; dorsal surface of carapace covered with sharp spines, the larger of which are arranged in about eight more or less regular longitudinal rows; the spaces between the major spines are almost entirely paved with lesser spines which are broad basally and margined anteriorly with a ring of fine setae; all the spines are forward-directed, acute- tipped. Above and projecting over the eye are a pair of long, curved, laterally compressed, acuminate, frontal horns. Just behind and in line with each of these is a row of three spines on each side anterior to the cervical suture and a row of five spines posterior to the cervical suture. These spines decrease in size posteriorly. There is a strong, laterally compressed spine at the postorbital angle, and another at the outer antennal angle. A distinct curved carina extends along the frontal border from the preorbital to the antennal spine. The posterior margin of the carapace is margined by a raised, smooth carina, anterior to which there is a smooth groove. The extreme hinder margin of the carina is setose. The lateral plates of the carapace are closely fused. The abdominal

segments are smooth, each with one transverse groove, which is accentuated by a band of silky, fine, brownish golden setae. The lateral angles of the somites are produced into acute teeth, directed posteriorly. In addition to this strong tooth, all somites, except the first one, have each a small, short, acute tooth at the postlateral angle. The median posterior margin of the sixth segment is irregularly denticulated. The telson has the proximal portion thickened and denticulated; the distal portion is more pliable, truncated, with the margin truncated, slightly rounded. The peduncle and outer proximal portion of each blade of the caudal fan is calcareous, thickened, with the inner distal-lateral margin denticulate, the remaining distal portion of the blades similar to that of the telson and ornamented with longitudinal rows of spinules and setae.

The eyes are set on calcareous stalks, constricted below the cornea.

There are a pair of submedian forward and upward-directed spines on the anterior part of the antennal segment, and, roughly speaking, in line with the rostral or preocular horns. The antennulae are slender; the first joint elongated, smooth; the second and third joints subequal, each about half as long as the first article; the whips are subequal, about as long as the peduncle, setose.

The antennae are distinctly slenderer than are those of *P. argus,* in specimens of the same size. *P. guttatus* has the proximal joint thickened, armed with two distal spines on the outer lateral margin; the second article is longer than the first, slenderer, with the upper and distal margin set with big spines; the third joint is similar to the second, almost as long, but slenderer, spinose; the whip is three to four times as long as the peduncle, composed of very short rings set with a series of sharp spines and bristling with setae on the ventral surface.

The legs are typically Panulirid, each with the propodus striped longitudinally with alternating lines of green and yellow.

Synonymy.—*Palinurus guttatus* Latreille, Ann. du Mus., vol. 3, p. 393, 1804; Encycl., pl. 315; Nouv. Dict. d'Hist. Nat., t. XVII, p. 295, 1817.—Olivier, Encycl., t. VIII, p. 672, 1811.— Lamarck, Hist. des Anim. sans Vert, t. V, p. 210, 1818.—Desmarest, Consid. sur les Crust., p. 185, 1825.—H. Milne Edwards, Hist. Nat. Crust., vol. 2, p. 297, pl. 23, fig. 1, 1834.—Von Martens, Archiv. fur Naturg., ser. 2, vol. 38, I, p. 125, 1872.

Panulirus guttatus Spence Bate, Rept. Voy. *"Challenger,"* Zoöl., vol. 24, pp. 78-79, pl. Xa (variety).—Verrill, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 17, pl. IX, fig. 2, 1922.

Homarus americanus H. Milne Edwards, about one-third of natural size.

Family: NEPHROPSIDAE.

Genus: **HOMARUS** H. Milne Edwards.

Homarus americanus H. Milne Edwards.

Plate 27.

TYPE: Described with no locality other than as indicated in the specific name; deposited in the Paris Museum.

DISTRIBUTION: Labrador to Delaware, from the tide-line to depths of 100 fms.

MATERIAL EXAMINED: One huge specimen from Eastport, Maine, and one very young specimen from the coast of Maine, also a very large dry specimen from the New England coast.

COLOR: The color of this lobster is quite variable. The more common form is a deep mottled bluish-green, the green a rich dark shade, the mottlings more abundant on the median dorsal surface, while the sides and lower surfaces have a yellow tone predominating. The spines of the rostrum, denticles on the carapace, and teeth on the claws are a vivid orange-red, also the tips of the other legs. The relatively soft skin covering the under parts of the abdomen and the swimmerets are salmon-pink and the many clusters of setae on other parts of the body are ruby-red.

LIFE HISTORY: See Herrick's exhaustive treatise.

TECHNICAL DESCRIPTION: This large, abundant, commercially important macruran is the well known "New England lobster," the only species in a strictly American genus. Specimens attaining a maximum of thirty pounds have been authentically recorded, although those usually taken for market average between one and three pounds weight.

The carapace is very robust, with the rostrum extending beyond the antennal peduncle, directed straight forward, except the acuminate tip, which is slightly upcurved and armed on each superior lateral margin with two or three denticles. The carapace is smooth, except for the well-defined cervical groove. The supraorbital and first antennal spines are small; the supraorbital spine is set well back upon the carapace, and a short carina composed of coarse denticles runs back from it for a short distance. The posterior margin of the carapace is accentuated by a flat carina set off anteriorly by a groove. The first abdominal segment is the shortest of the series; the second segment is the longest and has also the broadest epimera; the third segment is two-thirds as long as the second; the fourth segment is two-

thirds the length of the third, and the fifth is nearly subequal to the fourth; the sixth segment is about as long as the third, with the post-lateral margin excavate for the reception of the uropod peduncle; the telson is one and three-fifths times the length of the sixth segment; the distal margin is evenly rounded, a small tooth at each angle; the uropod peduncle is small, cut into two triangular points distally; the inner blade is as long as the telson and about as wide distally, with the distal margin shallowly rounded, and a small tooth at the outer distal angle; the outer blade is slightly longer and wider than the inner, with the distal margin more convex, the distal article of the blade separately articulated for five-sixths of its width. The distal margins of the entire caudal fan are fringed with short setae, as are also the posterior margins of the carapace and abdominal segments.

The antennulae are short, the first article excavate beneath the eye; the second and third articles short, subequal; the flagella short, the outer whip thicker than the inner.

The antennae have the first, second and third articles rather coarse, nearly as broad as long; the first article with a spine at the outer distal angle; the flagellum is nearly two-thirds as long as the body and is composed of thick, coarse rings; the scaphocerite is very small, the distal tooth reaching to midway the third peduncular joint; the blade is short and rounded, only as long as the second joint.

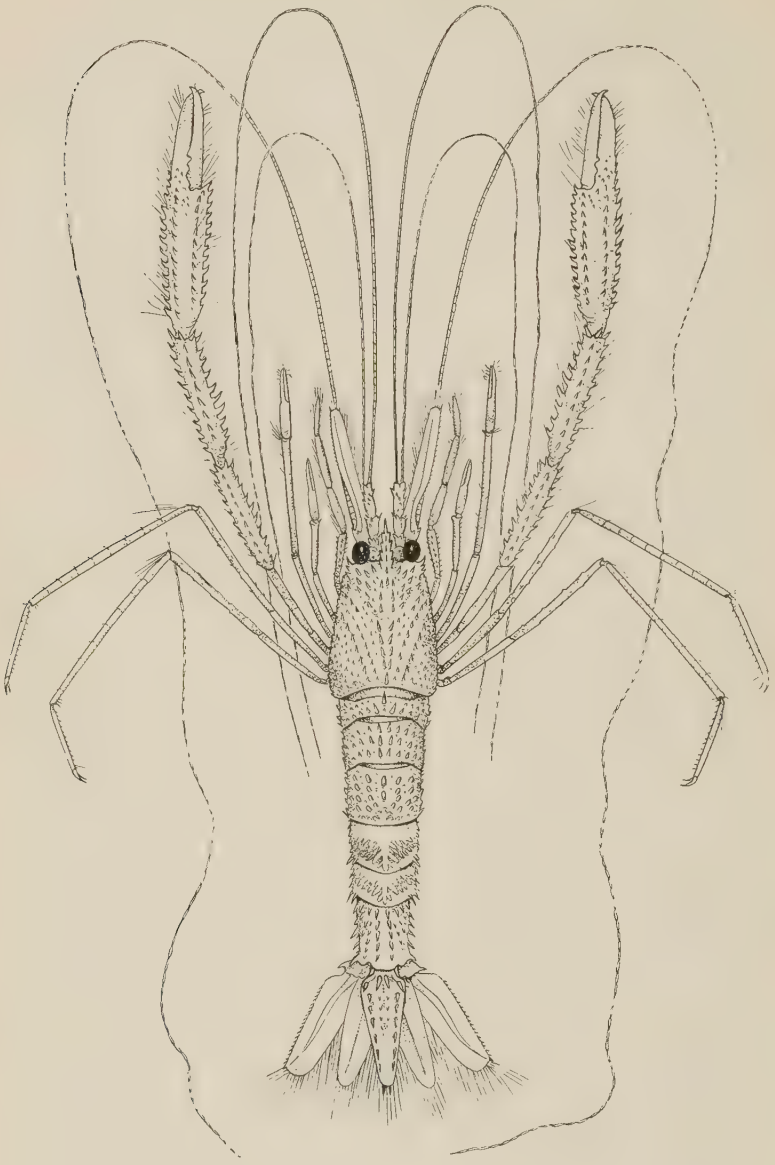
The eye is short, bulbous, black.

The first legs are large, unequal, slightly dissimilar in shape; the merus is short, triquetral, armed with a spine at each distal angle; the carpus is short, with several spines on the upper surface; the propodus is long, ovate, usually with a row of spines on the inner lateral margin of the palm. The fingers are fully as long as the palm, the hinged finger much slenderer than the broad lower finger, both set with coarse teeth on the large claw and smaller teeth in the lesser claw. The second and third legs are small, chelate.

The second and third legs are small, chelate.

The fourth and fifth legs are monodactyl, successively shorter than the others; the dactyli stocky, with sharp nail at the tip.

Synonymy.—*Homarus americanus* H. Milne Edwards, Hist. Nat. Crust., II, p. 334, 1837.—DeKay, N. Y. Fauna, Crust., vol. VI, p. 23, pl. 12, figs. 52-53, 1844.—S. I. Smith, Trans. Conn. Acad. Arts and Sci., vol. 2, p. 251, pls. 1-5, 1870.—Verrill, A. E., Rept. U. S. Fish. Comm., vol. I, p. 395, 1871-72; also p. 522, pl. 9, figs. 38-39, issued 1873.—S. I. Smith, *idem.*, pp. 522 and 549.—Kings-



Stenopus hispidus (Oliviér), × about 1.5.

LEY, Proc. Acad. Nat. Sci. Phil., p. 327, 1878.—S. I. SMITH, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 55, 1870.—R. RATHBUN, Rept. Fisheries U. S., p. 781, 1884.—KINGSLEY, Standard Nat. Hist., vol. 2, p. 53, 1884.—BENEDICT, Rept. U. S. Fish. Comm., vol. 11, for 1883, p. 176, issued 1885.—HERRICK, Bull. U. S. Fish. Comm., vol. 15, p. 5-252, pls. 1-54, 1895, issued 1896.—KINGSLEY, American Nat., vol. 33, p. 822, 1899.—M. J. RATHBUN, Occas. Papers Boston Soc. Nat. Hist., vol. 7, p. 18, 1905.—MAYER, Seashore Life, p. 83, fig. 52, 1906.—PAULMIER, 58th Ann. Rept. N. Y. State Mus., vol. 4, p. 133, 1906.—FOWLER, Rept. N. J. State Mus., Crust., p. 334, pls. 96-99, 1911 (issued 1913).

Astacus marinus (not Fabricius) SAY, Journ. Acad. Nat. Sci. Phila., vol. I, pt. 1, p. 165, 1817.

Family: **STENOPIDAE.**

Genus: **STENOPUS** Latreille.

Stenopus hispidus (Oliviér).

Plate 28.

TYPE: Oliviér's type specimen is deposited in the Paris Museum.

DISTRIBUTION: One of the most gorgeously colored and exquisitely sculptured of the reef-dwelling shrimps found in the tropic and subtropic waters of the eastern coasts of the Americas, also in the East Indies and South Pacific. Frequently associated with sea-fans and other Alcyonarians.

COLOR: See Boone, 1927, p. 83, for detailed description of color plate made by W. S. Bronson, from West Indian specimens.

MATERIAL EXAMINED: One very large specimen trapped in lobster pot, in the Bay Biscayne, off Miami, Florida, 1923: one specimen, Turtle Harbor, Fla., Apr. 29, 1922; one, Port Tanamo, Cuba, Feb. 23, 1924; one, Florida Reefs, 1923, by the *"Ara."*

TECHNICAL DESCRIPTION: Rostrum almost as long as the precervical region of the carapace, extending to about midway the second peduncular joint of the antennae, laminate, laterally compressed, armed with a median dorsal crest of sharp, high, forward-curved spines, one of which is the apex of the rostrum; the series is continued posteriorly to midway the cervical groove, where it bifurcates continuing posteriorly as a double row; one, occasionally two or three subdistal teeth on the inferior rostral margin; on the superior margin there is on each side of the median dorsal line of spines another row of four or five sharp spines directed forward and flared outward above the ocular space.

The carapace is short and very robust, with the cervical groove deep, the hepatic groove distinct. The entire dorsal surface is covered with sharp, forward-directed spines, which are arranged approximately in longitudinal rows, the spines on the lateral region being smaller than those of the anterior dorsal region. The abdomen, which is sharply angulated at the union of the third and fourth segments, is moderately robust, three times as long as the carapace, the first, second and third segments covered with spines similar to those of the carapace, except along the posterior margin of the third segment, where, in the median region, there is a small, embossed, tree-like figure composed of five or six radiating, flattish squamae and on either side of which there is a narrow bare band of carapace paralleling the posterior margin of the segment, and anterior to this bare space on either side is a patch composed of small spines. On the fourth segment the anterior two-fifths of the median region is bare, this space continuing laterally as far as on the preceding segment and also continued posteriorly in the median dorsal line, where another longer embossed, tree-like design is outlined by five radiating squamae, the top of the tree design being directed posteriorly. On either side of the design the posterior three-fifths of the segment is covered with small spines. On the fifth segment there is a bare space and median tree design directed posteriorly, similar to the one on the preceding segment. The sixth segment is about twice as long as the fifth and is entirely covered with sharp spines as on the carapace. The epimera of the first segment is bifid, produced into two acute triangles tapering into spines; those of the second, third, fourth and fifth segments are tapered distally, not exactly rounded, and each is armed distally with three spines placed in a row, one at the anterior angle, one, median and one at the posterior angle of the distal margin. There is an acute spine at the outer postlateral angle of the sixth segment and a series of spines on the ventral surface of this segment, which probably are of service in enabling the animal to retain its grasp of the sea-fans, etc. The telson comprises one-third of the length of the abdomen and bears two longitudinal rows of large spines which converge distally, and between which there are two approximate rows of smaller spinules and a median groove; the tips of the telson are ornamented with a larger pair of spines. The peduncle of the fan is small, spinose, the inner blade ovate, narrowing distally and with a deep median keel margined by two paired lines of spinules. The outer blade is wider with a subdistal spine at the outer angle, the distal margin broadly convex; both blades have ciliated margins.

The eyes are set on short, calcareous stalks which are dorsally spinose; the cornea large, convex, terminal.

The antennulae have a stocky peduncle, the first and second articles excavate beneath the eye; the distal margin of the first segment expanded and curved over upon the segment; the third article about as long as the second, stockier and spinose, as is also the upper distal margin of the second joint; the peduncle of the flagellum is one stocky ring, from which arise two slender flagella, of which the inner one, about as long as the body of the animal, is the shorter. The first fifteen to twenty rings of these flagella each have a spinule on the upper surface.

The antennae have two stocky, spinose peduncular joints, the second of which gives rise to the scaphocerite, which is as long as the carapace measured from the postorbital angle, and narrow, with the lateral margins parallel for the greater part of their length, except for a distinct curve inward of the proximal part of the outer lateral margin. This outer lateral margin is spinose and has a slender subdistal spine; the apex is convex. There is a pronounced median longitudinal keel which is microscopically spinose.

The first legs are small, slender, chelate, not as long as the external maxillipeds; when extended forward these legs reach to about midway the scaphocerite. The second legs are similar to the first pair, but longer; extending beyond the scaphocerite by about the length of the fingers. The third legs, which are approximately as long, or sometimes in old males longer than the entire body of the animal, are very attenuated proximally, the joints widening distally. The basis and ischium are fragile; the merus elongated, spinulose, wider a little distally; the carpus not quite as long as the merus, but noticeably wider, armed with about four longitudinal rows of sharp spines which are marginal; the palm is about as long as the carpus, but higher, somewhat compressed laterally; the fingers are about two-thirds as long as the palm and very slender, the tips curved, a sub-basal tooth on each finger. The palm and proximal half of the fingers are margined laterally by a row of sharp spines, and there are two additional rows of spines on each the outer and inner faces of the palm; also numerous long setae on the margin.

The fourth and fifth legs are very slender, the tip of the dactyl reaching to the base of the merus of the third leg; monodactyl, with an elongated, multiarticulate carpus, consisting of nine to twelve articles; a propodus about half as long as the carpus and armed on

its lower lateral margin with a row of spinules; the dactyl is one-fourth the length of the propodus, curved with a bifid, horny tip.

SYNONYMY.—*Palaemon hispidus* OLIVIÉR, Encyc. Méth. Insects, vol. VII, p. 666, 1811, pl. 319, fig. 2, 1818.

Stenopus hispidus LATREILLE, in DESMAREST, Dict. Sci. Nat., vol. XXVIII, p. 321, 1823; Illus. Ed.—CUVIÉR, Reg. Anim., vol. IV, p. 93.—DANA, U. S. Explor. Exped. Crust., vol. 13, p. 607, Atlas, pl. 40, fig. 8, 185 .—SPENCE BATE, Rept. Voy. *"Challenger,"* vol. 24, p. 211, pl. XXX, 1888.—BROOKS and HERRICK, Johns Hopkins Univ., Circ. No. 9, p. 66, 1892 (Exhaustive study of life history and color plate of adult and larval stage).—HERRICK, Mem. Nat. Acad. Sci., vol. V, pp. 339, 352, pl. V, colored, pls. 6-13, structure and metamorphoses, 1892.—RANKIN, Ann. N. Y. Acad. Sci., vol. XI, p. 240, pl. 29, fig. 1, 1898.—BORRADAILE, On the Stomatopoda and Macroura brought by Dr. Willey from the South Seas, Zoöl. Results, part IV, p. 407, 1900.—RATHBUN, Rapport Betreffende, etc., Visscherij Kolonie Curaçao, p. 325, 1907.—VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 36, pls. 9, 11, 12, 1922.—BOONE, Bull. Bingham, Oceanog. Coll., vol. 1, art. 2, p. 82, 1927.

Stenopus scutellatus Rankin.

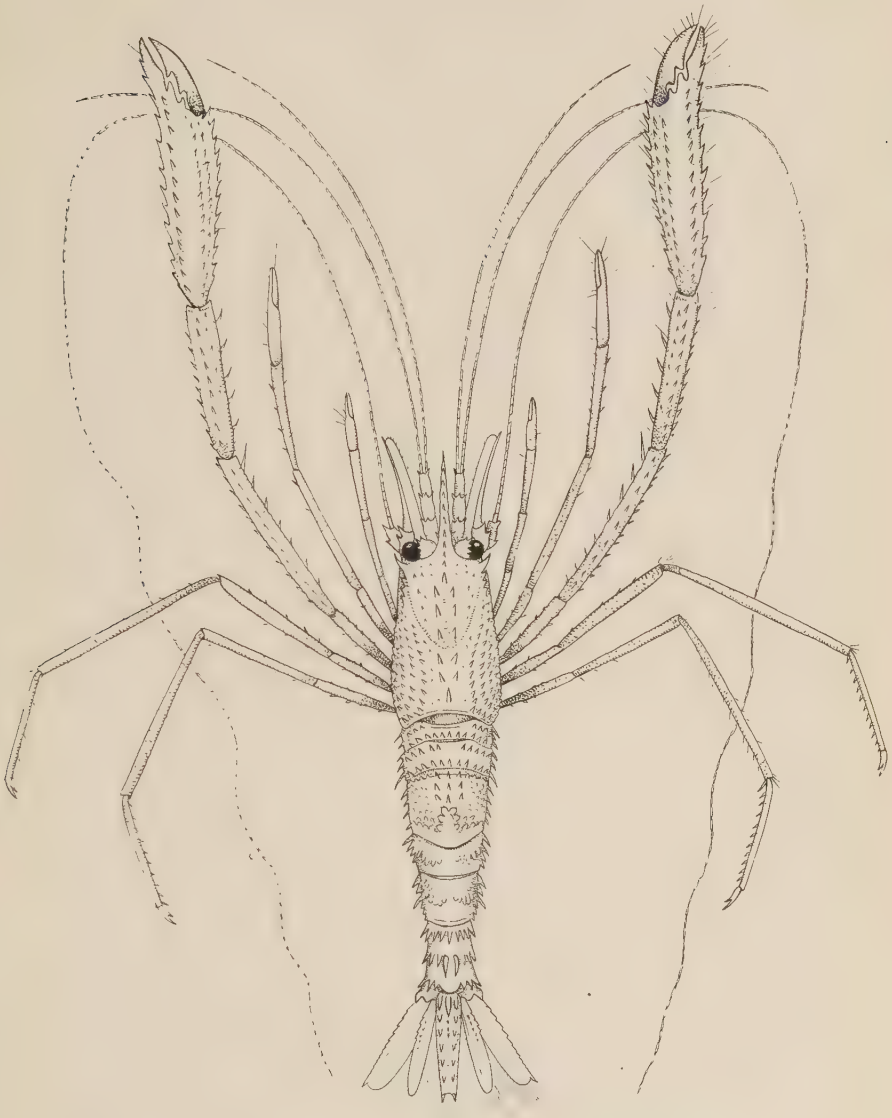
Plate 29.

TYPE: A male specimen taken under coral, near low water, Silver Cay, Bahamas, and believed to be no longer extant.

DISTRIBUTION: Known from the Bahamas, where the *"Ara"* specimens establish the second record; also from one female taken at Glover Reef, Caribbean.

MATERIAL EXAMINED: Two specimens, dredged in ten fathoms, Little Stirrup Cay, Bahamas, February 28, 1925, by the *"Ara."*

TECHNICAL DESCRIPTION: Rostrum one and one-half times the length of the precervical region, armed above with a row of about ten spines; no submedian spines present; midway the precervical region the rostral row of spines is succeeded by a double row which thus continues almost to the posterior margin where it is replaced by a single spine. The cervical groove is deep. The entire carapace is covered with fine spines set in approximately longitudinal rows. The spines are similar to those of *S. hispidus,* but slenderer, and apparently fewer and more delicate. The first two abdominal segments have the spines arranged in two well separated, forward-pointing, transverse rows, one each near the anterior and posterior margins of the respec-



Stenopus scutellatus Rankin, ×2.

Peneus brasiliensis Latreille, natural size.

tive segments; the third segment is about twice as long as the second, and has a shield-shape area on the posterior half of the median region with the apex of the shield rounded and directed forward; its anterior lateral margins are bordered by a series of raised, rounded bosses, as shown in the drawing. The anterior and lateral parts of this third segment are covered with forward-directed spines, those in the median and extreme lateral region being much longer than the smallish intermediate ones. The fourth, fifth and sixth segments successively increase in length in the order named; the fourth segment has one band of spines approximately midway the segment, and interrupted in the median area; the fifth segment has a similar band augmented by a few small spines on the lower anterior lateral region. The sixth segment has three such bands of spines, an anterior row, a median row emphasized by two longer, submedian spines in the dorsal region, and a scanter posterior row along the posterior margin of the segment. The entire caudal fan has the same contour and proportion as does that of *S. hispidus,* and the telson is similarly ornamented with two paired longitudinal rows of articulated spines.

The eyes and antennal appendages afford no specific characters. The different length ratio of the antennary flagella, pointed out by Rankin in the type, does not exist in the two adults before me.

The legs, likewise, are quite similar to those of *S. hispidus.* The fourth and fifth legs have the carpus and propodus multiarticulate; the carpus of the fourth leg with nine to twelve articles; the propodus with eight to twelve articles.

SYNONYMY.—*Stenopus scutellatus* RANKIN, Ann. New York Acad. Sci., vol. 11, p. 242, pl. 29, fig. 3, 1898.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 83, figs. and 16, 1927.

?Stenopus spinosus RATHBUN, Rapport betreffende een voorloopig onderzoek naar den toestand van de Visscherij en de Industrie van Zeeproducten in de Kolonie Curaçao, uitgebracht door Prof. D. J. Boeke, part 2, 1920, p. 325, 1907.—SCHMITT, Bijdr. tot d. Dierkunde K. Zoöl. Genooschap Nat. Art. Magistra Amsterdam, XXIII, p. 73, 1924. (Not *Stenopus spinosus* RISSO, 1826.)

Family: **PENAEIDAE.**

Genus: **PENEUS** Fabricius, restricted.

Peneus brasiliensis Latreille.

Plate 30, text fig. 1 A, B. C.

TYPE: Obtained on the coasts of Brazil; deposited in the Paris Museum.

DIAGNOSTIC CHARACTERS: This is the large, common, edible, shell-pink shrimp of the southern United States and tropic America. It is readily distinguished from its associates by the presence on each side of the rostral carina of a lateral sulcus, which extends the entire length of the carapace.

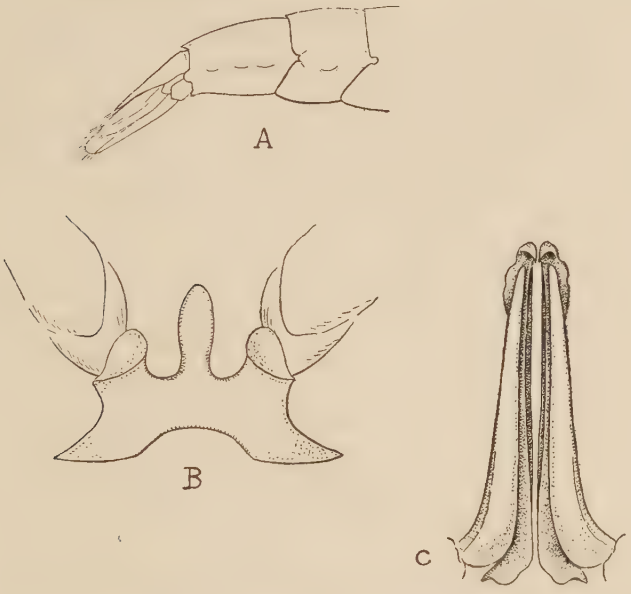
DISTRIBUTION: Littoral. Abundant, usually in schools, in the waters of the southern United States, occasionally swept northward in the Gulf Stream as far as Massachusetts. Abundant throughout the West Indian region as far south as Rio Grande du Sul, Brazil. Also found on the West African coast from Senegal as far south as Angola. Lefebrve indicates a fresh water habitat for the species at Lake Ahéme, Dahomey. So far as I am aware, the *"Ara"* specimen is the first record of the species from the Mediterranean Sea.

MATERIAL EXAMINED: Two specimens taken on the South coast of Cuba, field tag "G," February, 1925. One small specimen taken at Guantanamo, Cuba, February 17, 1928. One specimen taken at Turtle Harbor, Florida, January 10, 1923. One specimen dredged in 35 fathoms, 5 miles N. E. by N. of Cape Carthage, Gulf of Tunis, Mediterranean Sea, July 21, 1927. One, Port Antonio, Jamaica, 2 fms., February, 1926. Three, West Indies. All collected by the *"Ara,"* William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Average size 4 to 6 inches long. Animal rather robust, carapace not quite one-half as long as abdomen, exclusive of telson; rostrum prominent, slightly crested, extending beyond the eye as far forward as the subdistal spine on the lateral margin of the scaphocerite; thickened; armed on the superior margin with about eight teeth on the rostrum, and one more farther back on the carapace; the inferior margin armed with two or three teeth; the distal part of the rostrum directed straight forward. Posteriorly the rostrum is continuous with a strong median longitudinal carina, which extends to the posterior margin of the carapace, and is bordered on each side by a sharp sulcus which is continuous anteriorly in a lessened degree onto the proximal part of the carapace. There is a sharp antennal spine from which an oblique carina runs back to the sulcus just in front of the sharp hepatic spine. Subparallel to this carina is a wide deep sulcus which extends diagonally upward almost to the orbital margin and has its upper lateral margin defined by a carina. A small carina paralleled by a narrow groove runs back from the upper side of the hepatic spine obliquely toward, but not reaching the median line of the carapace. A similar, short,

oblique carina runs forward from the lower side of the hepatic spine and downward towards, but not reaching the pterygostomian angle. The posterior margin of the carapace is straight in a median region, but convex laterally, overlapping the first abdominal segment.

The abdomen is stout, the epimeral region of the first four segments moderately convex, that of the fifth segment also convex, but directed obliquely back, overlapping the proximal part of the long sixth segment. The posterior half of the fourth segment and the entire fifth and sixth segments are carinated sharply in the median longitudinal line, the carina terminating on the sixth segment. The sixth segment is one and one-third times as long as the fifth, and bears on each side



TEXT FIG. 1.—A. Lateral view of terminal abdominal segments, showing markings on the fifth and sixth segments, which are peculiar to *P. brasiliensis* and *P. setiferus*. B. Thelycum. C. Petasma of adult male.

three short, subequally spaced, slightly diagonal linear marks, each consisting of a carina below which is an accompanying sulcus. The telson is short, triangular, tapering to an acuminate point, a deep median longitudinal sulcus with a carinate lateral margin, extending the entire length of the telson. The rhipidura consists of a short peduncle, the inner blade intermediate in length between the telson and the outer blade, which latter is nearly one and one-half times

as long as the telson. The inner blade is narrower and unevenly rounded on its distal margin and has a median longitudinal groove, and is narrower than the outer blade which is less unevenly convex, distally, and has an oblique groove which runs to the angle of the outer lateral margin; this outer margin is also thickened.

The eye is large, reniform; the dorsal surface flattish with a calcareous plate covering the greater part of the surface; the lower part of the cornea is very convex, black, resting within the cup-like basal article of the antennae.

The antennulae have the basal article long, hollowed beneath the cornea; the second and third articles extremely short; the flagellum biramose, short.

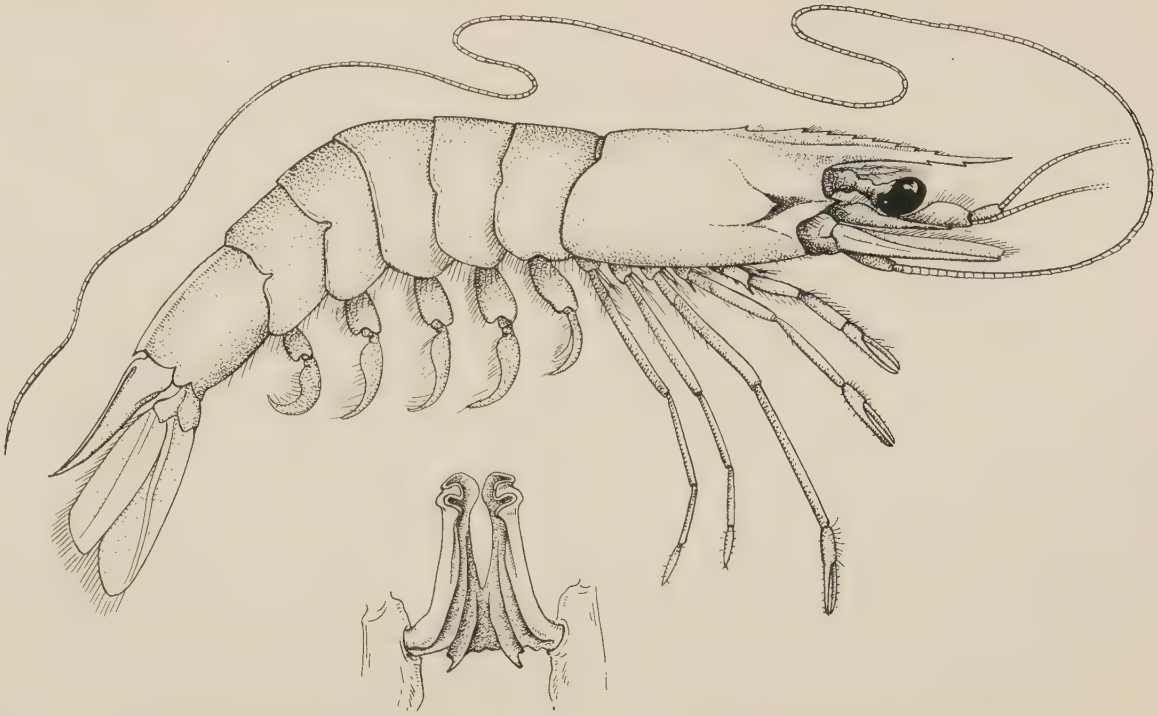
The antennae have a very short basal article, a scaphocerite which extends slightly beyond the tip of the antennular peduncle, and is elongate-oval with the outer margin thickened, terminating subdistally in a forward-pointing spine; the distal margin is slopingly rounded from the subdistal tooth to the inner edge. The second and third peduncular articles are extremely short; the flagellum is slender but nearly as long as the entire body.

The first, second and third legs are chelate, successively increasing in length in the order named; the fourth and fifth legs are monodactyl, successively longer than the third pair. All five pairs have each an epipodite.

The female thelycum lies between the bases of the fourth and fifth pairs of legs and consists essentially of two large plates, lying side by side between the bases of the fifth legs and together forming a shield-shaped plate, the inner edge of each half slightly upturned, carina-like. There is a smaller process placed medially between the bases of the fourth legs.

The male petasma is figured. (See text figure 1 B and 1C.)

Synonymy.—*Peneus brasiliensis* Latreille, Nouv. Dict. Hist. Nat., vol. 25, p. 156, 1817.—H. Milne Edwards, Hist. Nat. Crust., vol. 2, p. 414, 1877.—Stimpson, Ann. Lyc. Nat. Hist. New York, vol. 10, p. 132, 1871.—Smith, Trans. Conn. Acad. Arts and Sci., vol. 2, p. 27, 1872.—Von Martens, Archiv. fur Naturg., ser. 2, vol. XXXVIII, p. 140, 1872.—Coues, Proc. Acad. Nat. Sci. Phila., vol. 30, p. 124, 1871.—Kingsley, ibid, p. 330.—Miers, Proc. Zoöl. Soc. London, pp. 299-306, 1878.—Kingsley, Bull. Essex Inst., vol. XIV, p. 106 (2), 1883.—R. Rathbun, Fishes and Fish Industries U. S., Sect. I, text p. 822, 1844.—S. I.



Peneus setiferus (Linné), natural size. Lower figure, the petasma, much enlarged.

Smith, Proc. U. S. Nat. Mus., vol. III, p. 80, 1885 (1886).—Benedict, Proc. U. S. Nat. Mus., vol. 16, p. 540, 1893.—Mary J. Rathbun, Ann. Inst. Jamaica, vol. 1, art. 1, p. 46, 1897.—Bull. U. S. Fish Comm., vol. 20, pt. 2, p. 100, 1900 (issued 1901).—Verrill, Trans. Conn. Acad. Arts and Sci., vol. 10, p. 580, 1900.—M. J. Rathbun, Rapport Betreffende een vooloopig onderzoek naar den toestand van de visscherij in de Kolonie Curaçao, p. 319, 1907.—Lefebvre, Bull. Mus. Hist. Nat. Paris, vol. 14, p. 267, 1908.—A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zoöl., vol. 27, p. 235, pl. 6, figs. 11, 12, text figs, 64-67, 1909.—Pesta, Archiv. f. Naturg., vol. 81, abteil A, Heft I, p. 113, 1915.—Balss, Beitr. Kenntis Meeresfauna West Africa, vol. 2, p. 14, 1916.—Sumner, *et al,* Bull. U. S. Fish. Comm., vol. 31, pt. 2, p. 665, 1911.—Hay and Shore, *ibid,* vol. 35, p. 337, pl. 35, fig. 6, 1918.—Schmitt, Bijdragen tot der dierkunde, Amsterdam, 23E Alf., p. 61, 1924.—Bull. Amer. Mus. Nat. Hist., vol. 53, art. 1, p. 9, 1926.—Boone, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 78, 1927.

Peneus setiferus (Linnaeus).

Plate 31, figs. A and B.

Type: Habitat in the "Indies."

Distribution: From Beaufort, N. C., throughout the southern United States, the Gulf of Mexico and the upper West Indies.

Material examined: One specimen dredged in the Marquesas Keys, Florida, 30 fathoms, March 2, 1924, by the *"Ara."*

Color: In life this shrimp is a translucent bluish-white with irregular bands or splotches composed of minute black flecks.

Technical description: In size this shrimp approximates the well known *Peneus brasiliensis.* According to Mr. W. P. Hay, *P. setiferus* matures in greater abundance at Beaufort, N. C., earlier in the summer than does *P. brasiliensis,* both of which species are of economic importance in the Southern States and are also shipped to northern markets. *P. setiferus* has the following chief differences from *P. brasiliensis:* The rostral carina of *setiferus* extends not quite to the postlateral margin of the carapace, and the lateral sulci terminate posteriorly about opposite the hindmost rostral tooth, while in *brasiliensis* the median carina and its lateral sulci extend quite to the posterior margin of the carapace. The upper rostral margin of *setiferus* is armed with nine or ten teeth, the most anterior of which

is a little in advance of the eye; there are two teeth on the inferior margin. The apex is an acuminate thick tooth, reaching slightly farther forward than the scaphocerite. The supra-antennal and hepatic spines and hepatic suture are about the same as in *brasiliensis.* The abdominal segments are also similar to *brasiliensis;* in *setiferus* there is a median carina extending on the hinder three-fourths of the fourth segment, the entire fifth and sixth segments, terminating on the posterior margin of the latter in a small tooth. The telson has a median sulcus, throughout its length. As in *brasiliensis,* there are on the fifth abdominal segment on each side one short, diagonal mark, and similarly on the side of the sixth abdominal segment three, short, subequal linear marks, diagonally placed and equally spaced, as on the identical segments of *brasiliensis.*

The antennular peduncle is stocky, about as long as the scaphocerite, both normally a little shorter than the rostrum, but offering no specific characters.

Synonymy.—*Cancer setiferus* Linnaeus, Syst. Nat., ed. 12, p. 1054, 1767.

Peneus fluviatilis Say, Journ. Acad. Nat. Sci. Phila., p. 236, 1818.

Peneus setiferus H. Milne Edwards, Hist. Nat. Crust., vol. 2, p. 414, 1837.—Gibbes, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 199, 1850.—Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, p. 133, 1871.—Kingsley, Proc. Acad. Nat. Sci. Phila., vol. 30, p. 330, 1878-79.—R. Rathbun, Report Fisheries Indust. U. S., vol. 1, p. 821, pl. 273, 1884.—M. J. Rathbun, Proc. Wash. Acad. Sci., vol. II, p. 151, 1900.—Fowler, Report N. J. State Museum, Crust., p. 316, 1921.—Hay and Shore, Bul. U. S. Bur. Fish., vol. 35, p. 378, pl. 35, fig. 5, 1918.

Peneus brevirostris Kingsley.

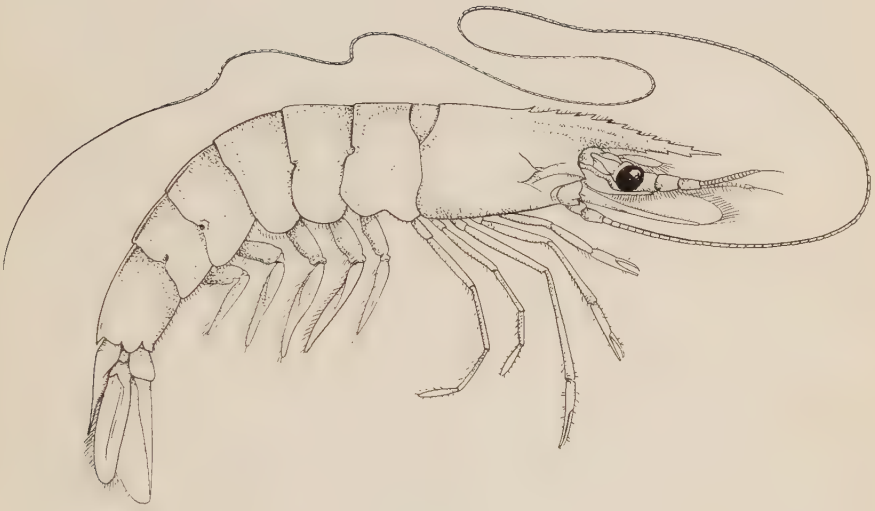
Plate 32, text fig. 2 A, B.

Type: Kingsley's type was taken at Realgo, Nicaragua, and is deposited in the Academy of Natural Sciences of Philadelphia.

Distribution: From San Francisco Bay, southward to the Pearl Islands, Panama, and also at the Galapagos Islands.

Material examined: One large specimen taken at Conway Bay, Indefatigable Island, Galapagos, March 1, 1926, by the *"Ara,"* William K. Vanderbilt, commanding.

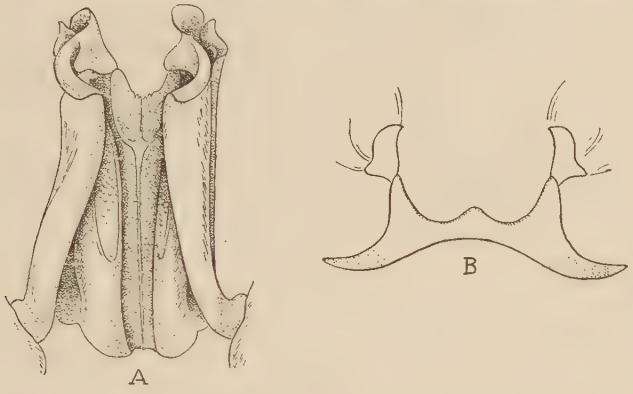
Color: This shrimp is a deep orange-pink both on the body and appendages, the deeper tone being accentuated along the suture lines



Peneus brevirostris Kingsley, one-half of natural size.

of the abdomen. There is a decided patch of seaweed-brown in the median dorsal region of the carapace just behind the rostrum. The eyes are deep brown.

TECHNICAL DESCRIPTION: Animal large, four to six inches long, being an average size. Carapace robust with the rostral carina prominent, continued posteriorly not quite to the hinder margin of the carapace. Rostrum strong, thick, short, reaching only as far forward as the scaphocerite, directed straight forward, armed on the inferior margin with two teeth and on the superior margin with about eight teeth, and one postrostral tooth. Adjacent to the rostrum



TEXT FIG. 2.—*Peneus brevirostris* Kingsley. A, B. Petasma X 3.

on either side there is a carina extending from about midway the length of the carapace forward onto the upper surface of the rostrum. There is a short antennal spine, also a small hepatic spine. There is a deep sulcus running forward from the hepatic spine to the base of the eye-stalk, and margined above by a short carina which begins near the base of the hepatic spine but does not extend quite to the frontal margin, and on the lower by a more prominent carina which runs obliquely backward from the antennal spine; a short, oblique carina lies below the hinder end of this larger carina.

The abdomen is stout, laterally compressed, a distinct median longitudinal carina on the fifth and sixth segments, terminating on the sixth segment in a slight spine. The first abdominal segment has the anterior half of the epimeral margin produced to a prominent triangle, the posterior portion convex; the epimera of the second, third and fourth segments are rounded, that of the fifth segment produced to a triangle at the postlateral angle; the sixth segment is about one and one-half times as long as the fifth; the telson is about

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Seattle, Washington.

as long as the sixth segment, tapering, triangular, with a very acuminate apex, and a decided median longitudinal sulcus. The rhipidura is very well developed with a strong, short base, the inner blade extending beyond the telson for nearly half its length with the distal margin unequally rounded, a median longitudinal ridge; the outer blade is of similar shape to the inner, but longer and slightly wider with an oblique ridge on the upper surface and the outer lateral margin nearly straight.

The eye-stalk is of moderate size, the cornea reniform, set obliquely terminal, very convex, nearly spherical, black.

The antennulae have the basal article long, excavate beneath the cornea, and giving rise on the inner upper proximal region to an elongate, flexible, tongue-like process which widens slightly distally and has the free end rounded; the entire margin ciliated, and the process extends to midway the second joint, which is thickened, two-thirds as wide basally as long, with a longitudinal line of cilia on the upper surface; the third joint is very small, short. The flagellum is biramose, both branches very short, composed of short rings.

The antennae have all the peduncular articles very short, the scaphocerite lobate, with the outer margins thickened, nearly straight except near the tip, the inner lateral margin convex, narrowing near the tip, which lacks but little from being triangular.

The first, second and third legs are chelate; the fourth and fifth pairs are monodactyl; all five pairs increase slightly in length from the first to fifth pairs.

The male petasma is figured (see text figure 2A and B).

The female thelycum is also distinctive.

Synonymy.—*Peneus brevirostris* Kingsley, Proc. Acad. Nat. Sci. Phila., vol. 30, p. 98, 1878.—Rathbun, Proc. Wash. Acad. Sci., vol. 4, p. 287, 1902.—Harriman, Alaska Exped., Crust., vol. 10, p. 146, 1904.—Schmitt, Univ. Calif. Publ. Zoöl., vol. 23, p. 21, fig. 9 *a-e*, 1921.

Peneus californiensis Holmes, Occas. Papers Calif. Acad. Sci., vol. 7, p. 218, pl. 4, figs. 64-69, 1900.

Genus: **PENAEOPSIS** Spence Bate.

Penaeopsis kishinouyei (Rathbun).

Plate 33, text fig. 3, A, B.

Type: The type and additional specimens were taken at Tagus Cove, on the reef north of Tagus Hill, Albemarle Island, Galapagos,

Penaeopsis kishinouyei (Rathbun), ×1.5.

March 16, 1898 or '99, by the Hopkins Stanford Expedition, and some more in a depth of two fathoms, at the same locality. The majority of the type series is deposited in the United States National Museum.

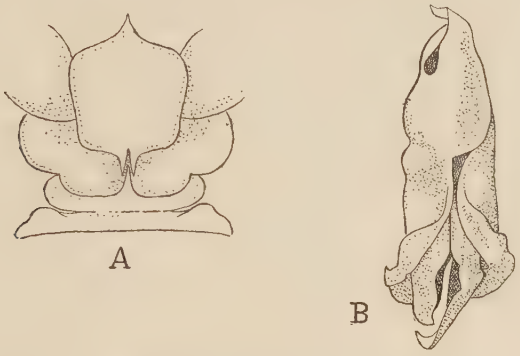
Named for the Japanese carcinologist, Dr. Kishinouye.

DISTRIBUTION: Galapagos Islands, Costa Rica.

The *"Ara"* specimen establishes the first record of the species from the continental coast.

MATERIAL EXAMINED: One adult male taken in dragnet, Punta Arenas, Costa Rica, February 14, 1928.

TECHNICAL DESCRIPTION: Animal about 55 mm. long, from tip of the rostrum to the tip of telson. Carapace 11 mm. long from orbital angle to posterior margin, rostrum 65 mm. long from tip to orbital angle, slender, arched above the eye, with the tip on a lower plane



TEXT FIG. 3.—*Penaeopsis kishinouyi* (Rathbun). A. Thelycum. B. Petasma much enlarged (after Rathbun).

and directed forward; armed on the upper margin with seven acute forward-directed teeth, in addition to the apical tooth and with a slight fringe of cilia between the teeth; the teeth are continuous to the tip of the rostrum. The lower margin is entire; the lateral carina curved, extending practically the entire length of the rostrum. The rostral carina is continued upon the carina for a very short distance, practically terminating at the median gastric spine which is acute. The entire carapace is covered with a fine pubescence. There is a sharp hepatic spine. The superior orbital spine is weak; the postorbital spine is well developed with a carina behind it.

The abdomen is somewhat compressed laterally, the fourth, fifth and sixth joints each having a median longitudinal carina which

terminates on the sixth segment in a minute tooth. The epimeral plates are not much produced. The telson is triangulate, about as long as the sixth segment. The rhipidura has a small peduncle, the inner blade long and narrow, with a tapered convex distal margin and a strong median longitudinal rib. The outer blade is wider, with the outer lateral margin thickened, the distal margin broadly rounded; both blades are fringed with a web-like brush of cilia on the distal and inner lateral margins.

The eye is large, reniform, with a flattish calcareous scale dorsally and very convex on the outer side.

The antennulae have the basal article long, concave beneath the eye, with an incised lateral process; the second article is narrowed elongate, with a lateral carina along the lower outer margin. The third article is small, bulbous; the flagellum is biarticulate, about as long as the entire peduncle; the branches of approximately equal length, the lower branch being the thicker and quite setose; the annulations of both whips are short.

The antennae have a short peduncle, the second article very small, the third article elongate cylindrical, scarcely one-third the length of the scaphocerite; the flagellum is multiarticulate.

The first, second and third legs are chelate, increasing in length in the order named. The basis and ischium of the first legs are each armed with a spine; two spines occur on the sternum between the bases of the second legs. The fourth and fifth legs are long, slender, monodactyl.

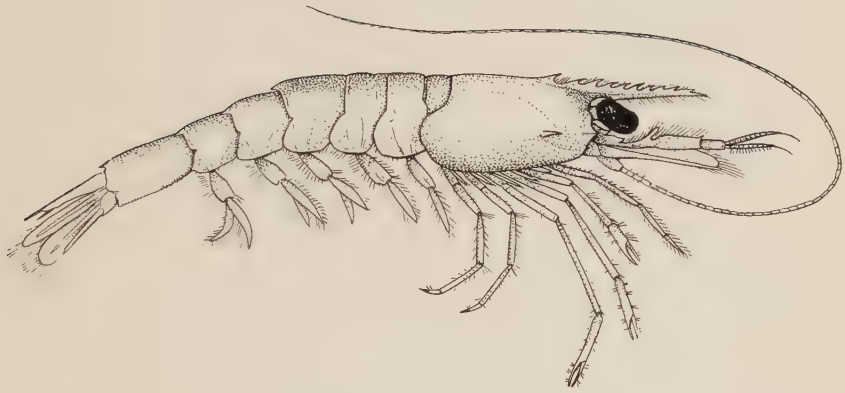
The petasma is asymmetrical, the left side the longer, with its distal portion ovate and quite narrowed at the anterior end. The thelycum has the lateral plates broad and fused, the central plate about semicircular.

SYNONYMY.—*Parapeneus kishinouyei* RATHBUN, Proc. Wash. Acad. Sci., vol. IV, p. 288, pl. 12, figs. 13-15, 1902.—Proc. U. S. Nat. Mus., vol. 38, p. 607.—SCHMITT, Zoölogica, N. Y. Zoöl. Soc., vol. V, p. 161, 1925.

Penaeopsis goodei (S. I. Smith).

Plate 34, text fig. 4 A, B.

TYPE: Collected at Bermuda, by Dr. G. Brown Goode, second secretary of the Smithsonian Institute, and deposited in the United States National Museum.



Penaeopsis goodei (S. I. Smith).

Distribution: From off the coast of the Southern United States, southward through the West Indies to Brazil, in shallow water.

Material examined: One specimen from American Shoal Light, Florida, 50 fathoms, March 3, 1924. One specimen from San Salvador, February 13, 1926. Three specimens, taken with dip-net at electric light, Hawks' Nest, Cat Island, Bahamas, January 15, 1928; two, Bimini, January, 1923, collected by the *"Ara."*

Color: A very delicate shade of shell-pink, with vivid black eyes.

Technical description: Animal 52.5 mm. long; rostrum from tip to orbital angle 8.5 mm. long; carapace 11 mm. long; abdomen about 33 mm. long.

Text fig. 4.—*Penaeopsis goodei* (S. I. Smith). A. Thelycum. B. Petasma, much enlarged.

Rostrum directed straight forward, lower margin smooth, upper margin armed with nine (sometimes 8 to 10) teeth, a slight short lateral carina; the rostrum reaches as far forward as the antennular peduncle; the carapace is ornamented with a median dorsal gastric spine behind which there is no carina; the entire surface is covered with a fine pubescence. There is a well-developed hepatic spine and a small antennal spine. The abdomen is moderately robust, with the epimeral plates scarcely at all produced. The third segment is longer in the median line than the second; the fifth and sixth segments each have a median dorsal carina, that of the sixth segment terminates in a short spine. The telson is only about two-thirds as long as the inner blade of the uropoda, triangular with a very acuminate median tooth, flanked by a pair of smaller, acute, subdistal teeth. The rhipidura have the inner blade very narrow, with a median ridge and a rounded, distal margin; all margins are ciliated. The outer blade is wider with a more broadly rounded distal margin, the outer lateral margin

thickened, and also a median ridge; the inner and distal margin ciliated.

The eye is very large, reniform, with the outer and lower surfaces very convex; shining black.

The antennulae have the basal article with an incised, acuminate-lobate, leaf-like lateral process on the outer side proximally, shielding the eye; also a small, rounded free process at the upper distal margin. The second article is cylindrical, about two-thirds as long as the preceding article; the distal article is small, cylindrical; the biramose flagellum is short, with the upper branch scarcely twice, the lower branch two and one-half times, as long as the third peduncular article.

The antennae have a short basal article which supports the long, narrow scaphocerite; the second article is rudimentary; the third article is somewhat longer, compressed cylindrical; the flagellum is very fine, about 47.5 mm. long.

The first, second and third legs are chelate, increasing in size in the order named, in the ratio shown in the accompanying illustration. The fourth and fifth legs are monodactyl, each with the merus and carpus subequal, elongated; the propodus almost as long as the carpus and the curved, tapering dactyl about one-half as long as the related propodus.

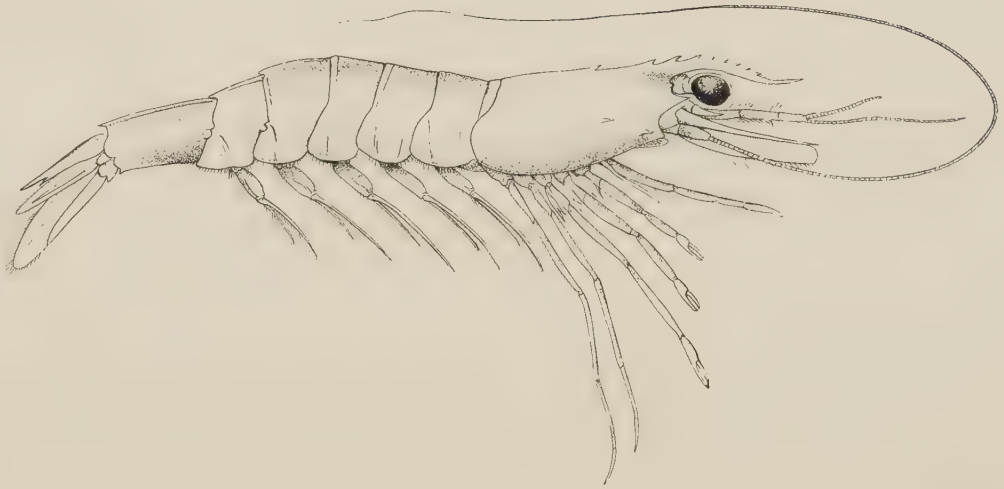
SYNONYMY.—*Parapeneus goodei* S. I. SMITH, Proc. U. S. Nat. Mus., vol. 8, p. 177, 1885.—RATHBUN, Proc. Wash. Acad. Sci., vol. 2, p. 152, 1900.

Parapenaeopsis rathbuni BOUVIER, Compt. Rend. Acad. Sci., CXLI, p. 748, 1905.

Archipenaeopsis vestitus BOUVIER, *op. cit.*, p. 755.

Metapenaeus goodei ALCOCK, Ann. Mag. Nat. Hist. (7), vol 16, p. 519, 1905.—Catal. Indian Macrura, p. 51, 1906.—RATHBUN, Rapport Betreffende een voorloopig onderzoek naar den toestand van de visscherij in de Kolonie Curaçao, p. 320, 1907.

Penaeopsis goodei BOUVIER, Bull. Mus. Oceanogr. Monaco, No. 119, p. 7, 1908.—BOUVIER and A. MILNE EDWARDS, Mem. Mus. Comp. Zoöl., vol. 27, p. 226, pl. 4, figs. 6-10, 1909.—A. E. VERRILL, Trans. Conn. Acad. and Sci., vol. 26, p. 44, pl. 15, figs. IA-IAiv, 1922.—SCHMITT, Bijdragen tot de dierkunde, Amsterdam, 23E Afl., p. 61, 1924.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 680, 1927.



Parapeneus longirostris (H. Lucas). Female, natural size.

Genus: **PARAPENEUS** S. I. Smith, restricted.

Parapeneus longirostris (H. Lucas).

Plate 35.

TYPE: This species was first taken at Cape Matifou, Algeria, and the type is deposited in the Paris Museum.

COLOR: Pearly-white.

DISTRIBUTION: Found in the Mediterranean Sea, on the coasts of Asia Minor, of North Africa, of the Hispanic peninsula and the adjacent shores of the Western Atlantic; littoral descending to a depth of 500 meters.

MATERIAL EXAMINED: Two specimens dredged in 100 fathoms, 9½ miles E. by S., ½ S., from Cape Bon Tunis, North Africa, Mediterranean Sea, July 19, 1927.

TECHNICAL DESCRIPTION: The specimen is a female, measuring 114 mm. long from the tip of the rostrum to the tip of the telson. The carapace is compressed laterally, finely setiferous; the rostrum slender, crested, arched above the eye, the distal third curved downward and directed straight forward, its acute tip extending forward for about five-sixths of the length of the scaphocerite and the carina is continuous posteriorly on the carapace as a rostral carina, which extends almost to the posterior border of the carapace; there is one, small, compressed, forward directed spine approximately midway the rostral carina and eight approximately subequally spaced spines on the rostrum, the hindermost one being approximately opposite the base of the ocular cavity and the distal spine being about one-fourth of the distance from the apex of the rostrum. There is a slight groove along the proximal third of the rostrum below which the rostrum is slightly thickened, convex; distally the rostrum is laterally compressed, blade-like. There is an hepatic spine, below, and slightly in advance of the ninth or post-rostral spine of the median carina. There is also an acute antennal spine, and a smaller, subdistal pterygostomian spine. The integument of the carapace is soft, semitransparent, the gills showing through it.

The abdomen is laterally compressed, the epimeral regions but little produced; those of the first four segments are similar, shallowly rounded, that of the fifth segment more angulated posteriorly. The sixth segment has a small spine subdistal to the postlateral angle. The third abdominal segment is slightly produced, with the median posterior margin rounded. The fourth, fifth and sixth segments

have a decided median longitudinal carina, which terminates on each segment posteriorly in a small spine. The telson is short, only two-thirds as long as the sixth segment, tapering, with a decided median longitudinal sulcus; there is a slight angulation, not a tooth, on each side, midway the lateral margin; the apex of the telson is very long, acuminate, and there is, on either side near the base of this median tooth, a small, acute, slightly outward-pointing tooth.

The peduncular article of the caudal fan is small, with a minute tooth at the outer distal angle; the inner blade is intermediate in length between the telson and outer blade, and is narrow; the lateral margins being approximately subparallel, the distal margin convex, all ciliated; there is a heavy, approximately median longitudinal groove bordered on each side, with a carina. The outer blade is substantially wider and longer than the inner, with a diagonal groove margined by a carina extending from the base to the outer margin, where it terminates subdistally in a small tooth.

The eye is large, reniform.

The antennulae have the article beneath the eye concave, with a pointed tip to the lateral portion near the base; the second article is long, cylindrical, slender; the third article is similar to the second; the flagellum is biramose, the second branch is nearly twice as long as the first.

The antennae have a short basal joint, a well developed scaphocerite, somewhat longer than the rostrum, with the outer margin thickened and produced to a spine at the distal end, which projects beyond the convex distal margin of the scale of the scaphocerite. The second and third peduncular articles of the antennae are short; the multiarticulate flagellum is about one and one-third times as long as the entire body of the shrimp.

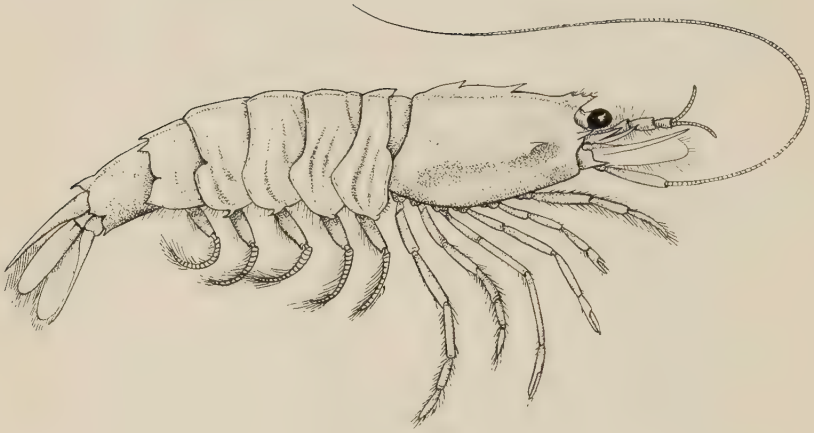
The first, second and third legs are chelate, and increase in length in the order named. The fourth and fifth legs are successively long and slender, monodactyl.

The female thelycum lies chiefly between the base of the fourth and fifth pairs of legs (See figure).

The very complicated petasma of the male is described by Bouvier, 1922, and figured by Spence Bate, 1881; also by Senna, 1903.

Synonymy.—*Peneus longirostris* H. Lucas, Explor. Sci. Algér., vol. 1, art. 3, p. 46, pl. 4, fig. 6, 1849.

Peneus membranaceus C. Heller, Sitzungsb. Ak. Wiss. Wien, Math-Naturv. Cl. B., XLIV, p. 423, taf. 2, fig. 49, 1862.—Die Crust. Sudl. Europa, Wien, p. 296, taf. X, fig. 11, 1863.—J. Y. Johnson,



Eusicyonia penicillata (Lockington), natural size.

Proc. Zoöl. Soc. London, p. 900, 1867.—E. J. Miers, *ibid,* p. 301, 1878.—A. Milne Edwards, Arch. Miss. Sci. et Litt., ser. 3, t. IX, Paris, p. 18, 1882.—J. V. Carus, Prodrom. Faunae Mediterranean, vol. I, p. 471, 1885.—I. Bolivar, Act. Soc. Esp. Hisp. Nat., 2, t. I, Madrid, p. 9, 1892.—T. Adensamer, Denksch. Math. Naturw. Cl. Akad. Wiss. Wien, B. LXV, p. 628, 1898.—Monticelli et Lo Bianco, Monit. Zoöl. Ital., anno. XI (suppl.), p. 30, 1900; *ibid,* 1901, pp. 198-200.—S. Lo Bianco, Mith. Zoöl. Stat. Neapel, B. XVI, Berlin, p. 437, 1902.

Peneus bocagei J. Y. Johnson, *op. cit.* for 1863, p. 255; *ibid* for 1867, p. 900.—De Britto Capello, Journ. Sci. Math., Phys. e Natur., No. XV, Lisboa, p. 240, 1873; *ibid* for 1877, p. 16.—Spence Bate, Ann. Nat. Hist., ser. 5, vol. VIII, p. 196, fig. 4, 1881.—B. Osirio, Jorn. Sc. Math., Phys. e Natur. (2), vol. I, Lisboa, p. 65, 1889.

Parapeneus longirostris S. I. Smith, Proc. U. S. Nat. Mus., vol. VI., p. 171, 1885.—E. L. Bouvier, Res. Campag. Sci. Monaco, fasc. XXXIII, p. 102, 1908.

Parapeneus membranaceus A. Alcock, Catal. Indian Deep-Sea Crust. Decap. Macroura and Anomala, Calcutta, 1901, p. 14.—A. Senna, Bull. Soc. Ent. Ital., vol. XXIV, p. 254, tav. V, figs. 5-11, et tav. VI, figs. 1-3, 1903.—E. L. Bouvier, Compt. Rend. Acad. des Sci., t. CXL, Paris, 1905, p. 980.

Subfamily: **Eusicyoninae.**

Genus: **EUSICYONIA** Stebbing.

Eusicyonia penicillata (Lockington).

Plate 36.

Type: Lockington's type material was taken in Bolinas Bay, Lower California, in 14 fathoms; also in Angeles Bay, Gulf of California, by W. J. Fisher. The depository of the type is not given, but the majority of Lockington's types are in the California Academy of Sciences.

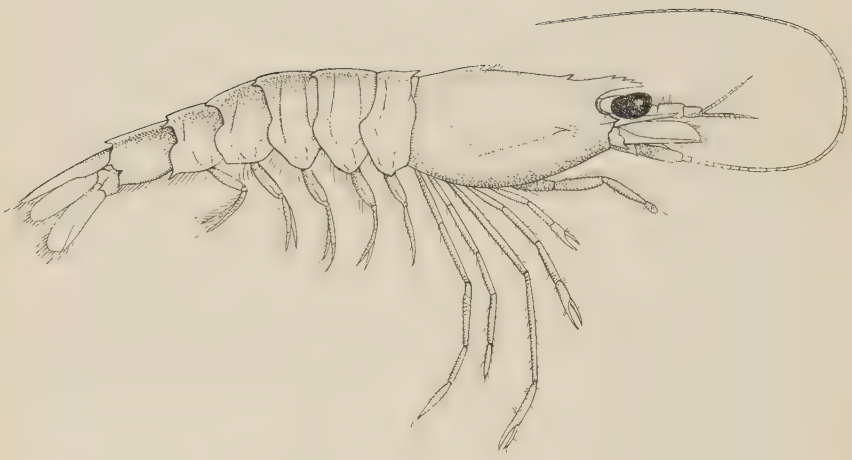
Faxon's type material, which I have examined, is in the Museum of Comparative Zoölogy. It consists of three males and three females, from the Albatross stations: 3367, 100 fathoms; and 3369, 52 fathoms, both of Cocos Island; and 3378, 52 fathoms; and 3379, 100 fathoms, off Malpelo Island.

Range: Gulf of California, southward to the vicinity of Malpelo Island; littoral to 100 fathoms.

Material examined: One specimen dredged in 100 fathoms, off Punta Arenas, Costa Rica, February, 1928.

TECHNICAL DESCRIPTION: Carapace robust, 24 mm. long, including rostrum; abdomen, 53 mm. long to tip of telson. Rostrum small, scarcely reaching to the base of cornea, armed with four teeth, armed distally with a short, acute tooth above and just a trifle posterior to which is another smooth tooth, behind which, at a slightly greater distance, is the third tooth, while the fourth rostral tooth is about at the beginning of the carapace. There is a laminate, median dorsal ridge extending the entire length of the carapace, and produced into a strong, slender, forward-directed triangulate spine about midway the carapace, and behind this, about two-thirds the distance from the posterior margin, is a stronger, basally broader, triangulate tooth, just anterior to which the carapace is higher and convex, and behind which it tapers down. There is an acute antennal spine behind which the carapace is raised in a slightly carinate ridge; also a sharp hepatic spine is present. The entire surface of the carapace is finely ciliated, and the posterolateral margin bears a flat carina.

The abdomen is robust with a distinctive median dorsal carina, which, on the first abdominal segment, is produced anteriorly into a high, prominent, laminate, triangular tooth, with the apex directed forward; the epimeral region is broadly rounded, with single, short, acute, forward-directed tooth. Two incomplete, transverse grooves ornament the lateral region of this segment. The second segment is much longer in the median line than the first, with the epimeral region, which is irregularly convex marginally, with a small tooth similar to that of the first segment. There are three transverse grooves on the second segment, the anterior of which is near the median region and terminates on either side by disappearing under the overlapping first segment; the other two grooves are similarly placed to those on the first segment, but are longer. The third segment is about as long in the median line as the second, with only two transverse grooves, the epimeral margin more convex and the marginal tooth more sharply outbent. The fourth abdominal segment is as long in the median line as the third, and has two transverse grooves laterally. The dorsal carina is slightly excavate posteriorly; the posterior margin is incised slightly below the median lateral region, and below this incision the margin is produced, convex; there is a single sharp out-bent spine at the extremity of the epimeral margin. The fifth abdominal segment is three-fourths as long in the median line as the preceding segment and bears on the carina a subdistal tooth separated by a brief concavity from the distal tooth of the carina which lies



Eusicyonia edwardsi (Miers), natural size.

close upon the sixth segment. The posterior margin of the fifth segment is incised similar to that of the fourth, and the epimeral region is more broadly rounded, with a single, acute spine at the postlateral angle. The sixth segment is nearly one and one-half times as long in the median dorsal line as the fifth, and terminates posteriorly in an acute laminate spine, which projects above the base of the telson; there is a single, acute, small spine at the inferior postlateral angle. The telson is one and one-half times as long as the sixth segment, and is narrow, tapering, acuminate. The rhipidura has a short base and two long blades, the outer of which is the larger with a short, subdistal tooth on the outer lateral margin; the distal margins of both blades are convex.

The eye is small, spherical.

The antennulae have the basal article elongate and excavate beneath the eye and with two sharp spines on the outer lateral margin, one behind the other and both in line with the antennal spine; the second and third articles are short, cylindrical; the third being only half as long as the second; the two branches of the flagellum are short, subequal, either branch being about as long as the two preceding peduncular joints.

The antennae have a short basal article with an acute spine at its outer distal angle, the second joint short, cylindrical; the third joint elongate cylindrical, extending three-fourths of the length of the scaphocerite. The flagellum is rather thick, about as long as the scaphocerite. The scaphocerite extends rather farther forward than the antennular peduncle and has the outer edge thickened, terminating subdistally in a very acuminate spine; the distal margin is evenly convex, ciliated.

The first, second and third pairs of legs are subchelate; the fourth and fifth pairs monodactyl, with the dactyl rather long.

Synonymy.—*Sicyonia penicillata* Lockington, Bull. Essex Inst., vol. 10, p. 164, 1878 (1879), publ. Salem, Mass.—Schmitt, Proc. Calif. Acad. Sci., ser. 4, vol. 13, p. 387, 1923.

Sicyonia affinis Faxon, Bull. Mus. Comp. Zoöl., vol. 24, p. 209, 1893; Mem. Comp. Zoöl., vol. 18, p. 179, pl. 46, figs. 1-1c, 1895.

Eusicyonia edwardsi (E. J. Miers).

Plate 37.

Type: Miers designated the name *edwardsi* for Milne Edwards' species *carinata*, which came from Rio de Janeiro, Brazil, and was deposited in the Paris Museum.

DISTRIBUTION: Confined to the West Indian region.

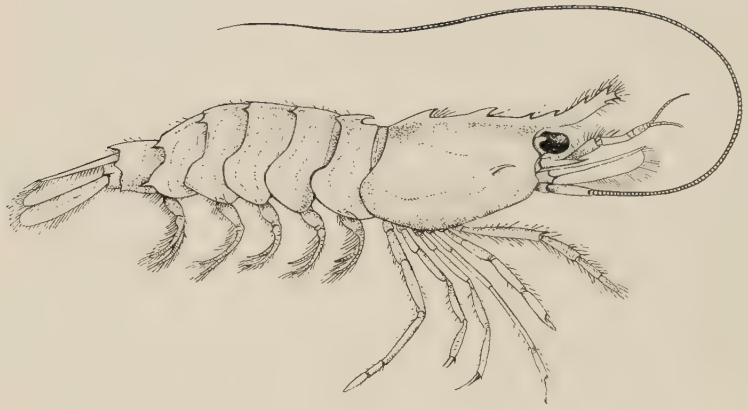
MATERIAL EXAMINED: One specimen dredged in Limon Bay, Panama, 1926.

TECHNICAL DESCRIPTION: Carapace robust, rostrum about as long as the eye, with the tip bifid; the upper margin armed with three teeth, subequally spaced; the first one just behind the rostrum; the third tooth slightly in advance of the orbital angle; the second tooth midway between these two. There is a well developed dorsal gastric spine, and about halfway the distance between this and the posterior margin there is a second, larger, upward-pointing spine, behind which the dorsal carina extends to the posterior margin. There is a small sharp hepatic spine and a bluntly triangular postorbital spine. The abdomen has a median longitudinal crest, which on the first segment terminates in a forward-directed triangular tooth. The second, third and fourth segments each terminate in a slight point which is not elevated above the carina; on the fifth segment the carina is subdistally emarginate posteriorly; on the sixth segment it terminates posteriorly in an acute tooth. The first five segments have each a transverse carina sculpturing a deep line, slightly differently placed on each segment. The epimera are but little produced and are irregularly rounded, those of no two segments being identical; the fourth, fifth and sixth segments each have a small tooth at the postlateral angle. The caudal fan has a slender triangulate telson and two ovate blades of about equal length as the telson.

The eyes are large, reniform; extending about as far as the rostrum, with the upper surface flat; the outer and lower surfaces very convex.

The antennulae are not very concave beneath the eye and have the outer lateral margin, a thickened ridge, produced distally into an acute spine which extends half the length of the second segment; the second segment is cylindrical, short, ciliated; the third segment is only half as long as the second segment, cylindrical; the two branches of the flagellum are of nearly equal length, each about equal in length to the two preceding peduncular joints.

The antennae have a short basal article with an acute spine at the outer distal angle; the scaphocerite is as long as the peduncular articles of the antennulae, with the outer lateral margin much thickened, terminating distally in an acute spine. The distal margin is evenly convex, ciliated. The second peduncular article is short, cylindrical; the third article somewhat elongated, extending three-



Eusicyonia dorsalis (Kingsley), natural size.

fourths of the length of the scaphocerite; the flagellum is about half as long as the body of the animal.

The first three pairs of legs are chelate; the fourth and fifth pairs are monodactyl; the series increase in length in the order named.

SYNONYMY.—*Sicyonia edwardsi* E. J. MIERS, Ann. Nat. Hist. (5), vol. 8, p. 367, 1881.—FAXON, Mem. Mus. Comp. Zoöl., vol. XVIII, p. 179, 1895; Bull. Mus. Comp. Zoöl., vol. XXX, p. 162, 1896.—RATHBUN, Rapport Betreffende een voorloopig onderzoek naar den toestand van de visscherij en de industrie van Zeeproducten in de Kolonie Curaçao, 1907, p. 319.—A. MILNE EDWARDS and E. L. BOUVIER, Mem. Mus. Comp. Zoöl., vol. 47, p. 251, pl. 8, figs. 1-3, 1909.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 82, 1927.

Sicyonia carinata H. MILNE EDWARDS, Ann. Sci. Nat., t XIX, p. 344, pl. IX, fig. 9, 1830; Hist. Nat. des Crust., vol. II, p. 410, 1837.—A. WHITE, List Crust. Brit. Mus., p. 79, 1847.—DANA, U. S. Explor. Exped. Crust., vol. 13, p. 602, pl. 40, fig. 1, 1852.—VON MARTENS, Arch. f. Naturg. Jahrg., vol. 38, p. 142, 1872.—KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1879, p. 427.—SPENCE BATE, Ann. and Mag. Nat. Hist., ser. 5, vol. 8, p. 367, 1881; Rept. Voy. *"Challenger"* Zoöl., vol. 24, p. 294, pl. 43, figs. 2-3, 1888.

Eusicyonia dorsalis (Kingsley).

Plate 38.

TYPE: Taken at Fort Jefferson, Florida, by Lieutenant W. H. Jaques, U. S. N., deposited in the Peabody Academy of Science, at Salem, Mass.

DISTRIBUTION: West Indian region; frequently found among the ribbon grass.

MATERIAL EXAMINED: One specimen, taken in 2 fms., Port Tanamo, Cuba, February 23, 1925, by the *"Ara."*

TECHNICAL DESCRIPTION: This species is the West Indian analog of *E. picta* Faxon of the American Pacific waters. *E. dorsalis* is readily distinguished from the other West Indian species by the dentition of its rostrum, which is subacute, extending beyond the eyes, somewhat elevated distally, armed on the upper margin with three small teeth and with the apex bifid, each angle forming a tooth; on the inferior margin there is a subdistal tooth opposite the subdistal tooth of the upper margin. The carapace has a dorsal carina which is interrupted by two teeth, the smaller anterior one not far behind the base of the rostrum and in

line with the hepatic spine, and a much larger tooth, placed about one-third the length of the carapace from its hinder margin. There is also a strong hepatic tooth. The carinal tooth of the first abdominal segment is strong, triangular, with the apex directed forward. The fifth and sixth segments have each a median tooth on the posterior margin on either side of which there is a slight excavation, followed by a small tooth. The abdominal segments are sculptured by carinae; the epimeral margins are rather broadly rounded except that of the fifth segment which has a sharp denticle at its posterolateral angle.

Synonymy.—*Sicyonia stimpsoni* A. Milne Edwards, Mss.—E. L. Bouvier, C. R. Acad. du Science, tome CXLI, p. 748, 1905.

Sicyonia dorsalis J. S. Kingsley, Proc. Acad. Natural Sciences Philadelphia, p. 97, 1878.—M. J. Rathbun, Rept. U. S. Fish Comm., 1900 (issued 1901), part 2, p. 103.—A. Milne Edwards and E. L. Bouvier, Mem. Mus. Comp. Zoöl., vol. 27, p. 253, text figs. 86, 87, 88, pl. 8, figs. 4-13, 1909.—Verrill, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 49, pl. 10, figs. 1-1*i*, 2 a-c, 3, 4, 5, 1922.

?Sicyonia dorsalis S. I. Smith, Rept. U. S. Comm. Fish and Fisheries for 1885, p. 80, 1886.

Family: SERGESTIDAE.

Genus: SERGESTES H. Milne Edwards.

Sergestes corniculum Kroyer.

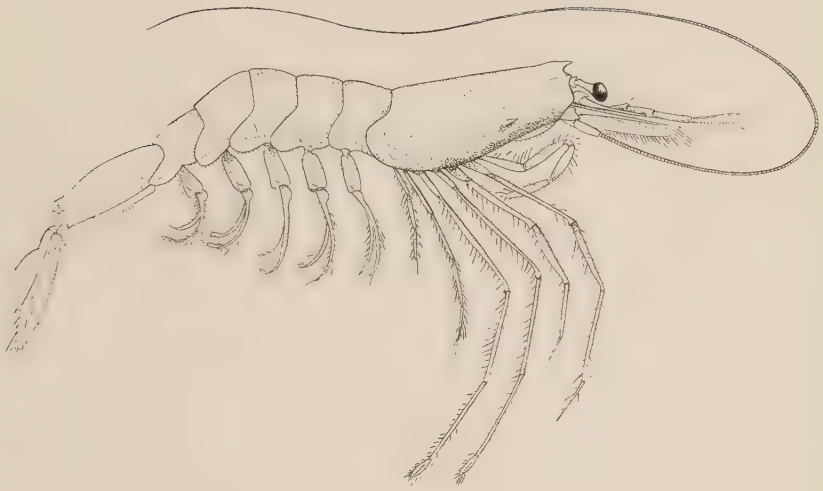
Plate 39.

Material examined: Two specimens taken S. by E. of Monaco Harbor, Mediterranean Sea; depth, 900 fathoms, April 19, 1927, by the "*Ara*," William K. Vanderbilt, commanding.

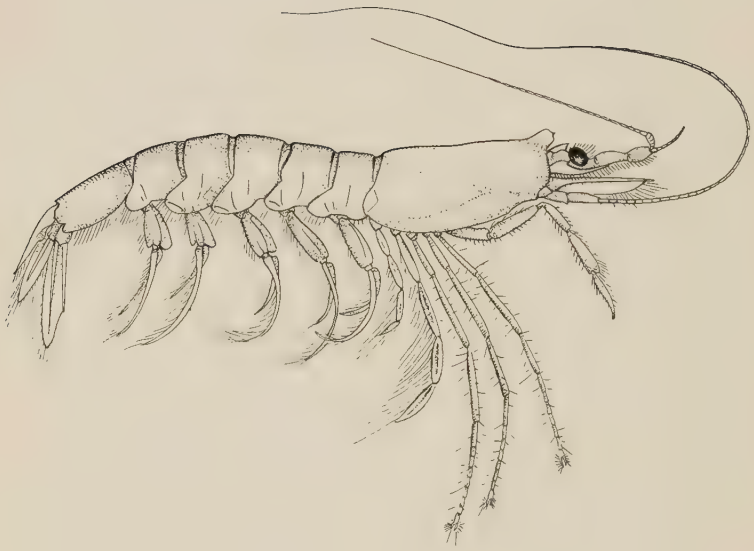
Color: The exquisite color-plate of this schizopod in the Monaco Report shows two color phases, one in which the carapace and anterior dorsal region of the abdomen are red with freckle-like spots of deeper red; the anterior and entire posterior parts of the abdomen creamy; in the second figure the coloration is the same, except that the red of the carapace is deeper and there are black splotches in the hinder two-thirds of the dorsal region of the carapace.

Discussion: This species, with its various growth stages, has been so frequently taken and described that it is one of the best known members of the genus.

Synonymy.—*Sergestes corniculum* H. Kroyer, Overs. Vid. Selsk. Forh., p. 30, 1855; Vid. Selsk. Skr. 5, Raekke, Naturv. Math.



Sergestes corniculum Kroyer, ×2.



Sergestes phorcus Faxon, ×1.4.

Afd. 4, Bind. Kjobenhavn, p. 252, p. 278, p. 285, pl. 3, figs. 4, a-e, 1859.—A. Ortmann, Ergebnisse der Plankton-Exp. der Humboldt-Stiftung, Bd. II, Kiel und Leipsig, p. 38, pl. 3, fig. 3, 1893. —A. Konig, Denkschr. Math.-Naturv. Kl. Akad. Wiss. Wien, Bd. 62, Wien, p. 13, pl. 2, figs. 12-13, pl. 3, figs. 15, 16, 1893.—H. J. Hansen, Proc. Zoöl. Soc. London, 1896, p. 957; Sergestidae of the Siboga Expedition, Siboga Exped., vol. 38, Leiden, p. 21, 1919; Results Campag. Sci. Monaco, Fasc. 44, p. 126, pl. i, figs. 6-7m, Colored, 1922.—A. Senna, Bull. Soc. Entom. Ital., Anno. 34, Iv, Firenze, p. 285, pl. 10, figs. 1-14, 1903.—G. Illig, Deutsche Sudp.-Exp. Band. XV, Zoöl. VII, Berlin, p. 357, figs. 6-10, 1914.—O. Sund, Michael Sars North Atlantic Deep Sea Exped. 1910, vol. 3, pt. 2, Zoöl., Bergen, 1920, p. 9, figs. 6-10, 1920.

Sergestes phorcus Faxon.

Plate 40.

Type: Mr. Faxon's type material was taken at six Albatross stations, between Cocos Island and Malpelo Island, and in the Galapagos Islands, in depths ranging from 292 to 1793 fathoms.

Distribution: Tropical American Pacific, deep-sea.

Material examined: One specimen, dredge down 300 fathoms—depth, 1400 fathoms—Pacific Ocean, seven miles off Cape Malo, Panama, March 30, 1926, by the *"Ara."*

Color: Living specimens spectrum red.

Technical description: Rostrum short, upward directed, distal margin produced to a small, median point on either side of which it is convex; the upper lateral margin of the rostrum does not continue posteriorly on the carapace as a carina.

The carapace is soft, smooth, semitransparent, somewhat compressed laterally. The frontal margin is slightly sinuate, being shallowly excavate behind the eye and produced to a moderate convex lobe at the antennal base, beyond which it is again excavate. The concave anterolateral margin is fringed with cilia; the lateral margin is convex and bent under the body. There are two clearly defined transverse grooves on the carapace, the cervical, which occurs about two-fifths of the length of the carapace from the rostrum and curves downward, uniting with a longitudinal lateral groove that extends forward to the anterolateral angle, and posteriorly to beside the strong longitudinal carina, which extends from the urogastric line to

almost the posterior margin. The second transverse groove is the urogastric, which is situated two-fifths of the carapace length from the hind margin; it unites with a longitudinal groove, which parallels the heavy carina on its upper side. There is also a lighter curved carina not far above the lateral margin, not reaching to the posterior margin, and curving upward anteriorly to unite with the long, longitudinal groove. There is a short, curved groove extending from the anterior margin of this carina, down to the lateral margin of the carapace. The postlateral margins of the carapace are somewhat produced, convex, overlapping the first abdominal segment; the posterior margin of the carapace is relatively straight in the median line.

The carapace is 21 mm. long; the abdomen segments, one to six, 32 mm. long; the telson 8 mm. long. The first, second and third abdominal segments are subequal in length, each 5 mm. long in the median line; the fourth segment is 6 mm. long; the fifth segment is 5 mm. long and the sixth segment is 10 mm. long. The first five segments have the posterior margin sinuate in the median and upper lateral regions, on the median lateral region the margin is slightly notched, beyond which the margin runs obliquely outward, uniting with the convex lateral margin; this portion of each segment is thus produced, overlapping the segment following. The first abdominal segment has a transverse groove across the median region, just behind the anterior margin, which then extends across the segment obliquely to the notch on the lateral region of the posterior margin; two other, shorter, grooves unite with this and with each other circumscribing a triangular area whose apex nearly reaches the triangular margin. The lateral margin of the first segment is excavate in a straight line above the basal joint of the leg, and convex and ciliated anteriorly and posteriorly. The second abdominal segment has a short curved groove extending backward from the notch on the posterior margin of the first segment, almost to the middle of the second segment. There is a narrower subtriangulate figure outlined on the lateral part of this segment, its upper angle reaching to the notch on the posterior margin of the second segment; another short, forward-directed groove runs from this apex a third of the length of the segment across it; the lateral margin of the second segment is excavate anteriorly and very convex on the posterior half. The third segment is similarly ornamented laterally and margined as the second; the fourth segment is similar to the third, except that the convex hinder half of its

margin is more emphasized; the outlined triangular area is narrower and the upper forward-directed groove extends nearly two-thirds the distance across the segment; the fifth segment has a curved carina paralleled by a groove extending from the notch on the posterior margin of the fifth segment to the notch on the margin of the fourth segment, and there is also a groove beginning at the notch on the posterior margin of the second segment; another short, forward-directed groove runs from this apex a third of the length of the segment across it; the lateral margin of the second segment is excavate anteriorly and very convex on the posterior half. The third segment is similarly ornamented laterally and margined as the second; the fourth segment is similar to the third, except that the convex hinder half of its margin is more emphasized; the outlined triangular area is narrower and the upper, forward-directed groove extends nearly two-thirds the distance across the segment. The fifth segment has a curved carina parallelled by a groove extending from the notch on the posterior margin of the fifth segment to the notch on the margin of the fourth segment; there is also a groove beginning at the notch on the posterior margin of the fifth segment and curves forward and down to the anterior lateral margin; a smaller groove branches from the main groove and runs down onto the posterior lateral lobe. The long sixth segment is much compressed, laterally; has its lateral margin shallowly convex and ciliated; a long curved groove runs from the notch on the posterior margin of the fifth segment to within about two millimeters of the posterior margin of the sixth segment. There is a minute median tooth on the posterior margin of the sixth segment and a fine fringe of plumose cilia across the median part; the lateral part of the posterior margin is produced into two processes at the other margin of the telson and the base of the caudal fan.

The telson is about three-fourths as long as the preceding segment and three-fifths as long as the uropoda. It is triangulate, tapering, with the tip bluntly rounded; the dorsal surface of the telson is concave, separated by a pair of longitudinal carinae from the lateral region; a lesser carina on each side extends from opposite the upper angle of the produced larger lobe of the posterior margin to about two-fifths of the length of the telson; a smaller curved, laminate carina extends from the outer basal margin of the telson about three-fifths of the length of the above carina. Just below and beneath this, there is a short groove, and about at its distal termination there

occurs a rounded, slightly produced, lobe on the lateral margin, beyond which the lateral margin is ciliate, oblique.

The base of the uropoda is small, the inner lobe forming an acute triangle, the outer lobe broadly convex. The inner blade is only 8 mm. long, narrow, tapering to a narrowly rounded apex; the outer blade is 11 mm. long and is wider than the inner blade; the longitudinal groove is nearer the outer margin and extends obliquely, terminating on the outer margin in a denticle, situated about one-fourth of the length from the distal apex. Both blades are heavily ciliated.

The eyes are spherical, terminal and of much greater diameter than the stalk which is short, very narrow basally, dilating moderately distally.

The inner antennae have the basal joint excavated cup-shaped beneath the eye and ciliate on the inner proximal and distal margins of this excavation; the second article is cylindrical, about as long as the first; the third article is not quite as long as the second, and convex, tapering distally like a truncated cone; the flagellem, which is broken, retains 32 articles; Faxon states that is quite long.

The outer antennae have the bulbous basal article concealed beneath the carapace and supporting the scaphocerite, which extends to midway the length of the distal peduncular segment of the antennae, and is rather wide, with a ridge along the outer lateral margin, terminating subdistally in a small, acute tooth; the distal margin is evenly rounded, the inner lateral margin slightly convex, both heavily fringed with plumose cilia. The smaller but dilated second and third articles lie beneath the scaphocerite, extending midway its length; the flagellum, broken in the present specimen, is said by Dr. Faxon to be very fine and long.

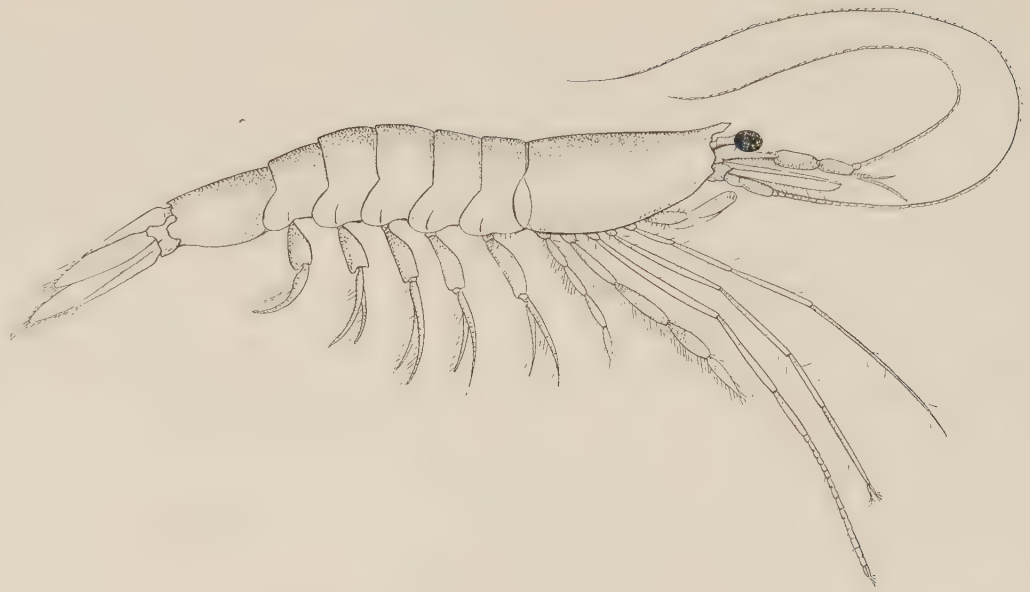
SYNONYMY.—*Sergestes phorcus* FAXON, Bull. Mus. Comp. Zoöl., vol. 24, p. 217, 1893.—H. J. HANSEN, Sergestidae Siboga Exped. Mon., 38, pp. 7 and 10, 1919, Leyden.

Sergestes bisulcatus FAXON (not Wood-Mason), Mem. Mus. Comp. Zoöl., vol. 18, p. 210, pl. 52, 1895.

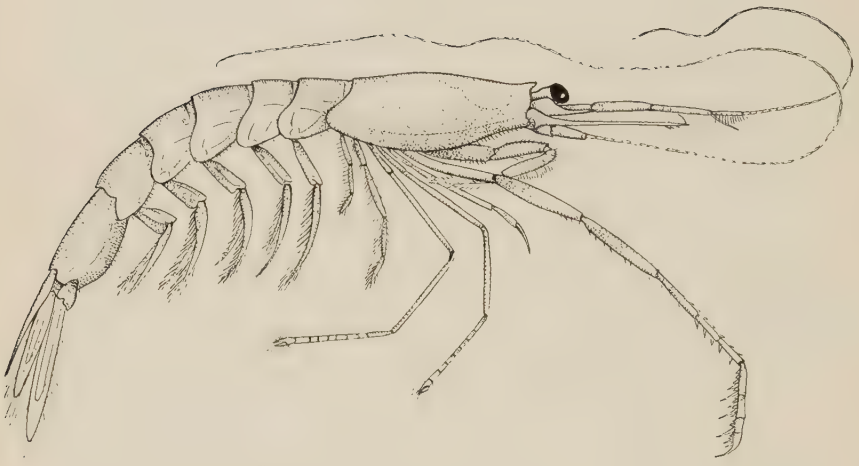
Sergestes robustus S. I. Smith.

Plate 41.

TYPE: The species was founded on four males, three of which were taken by the U. S. Bureau of Fisheries, off Martha's Vineyard, in 372



Sergestes robustus S. I. Smith, ×1.5.



Sergestes vigilax Stimpson, ×2.5.

to 388 fms.; one specimen from *"Blake"* station 328 in 1632 fms.; depository not stated.

DISTRIBUTION: The reliably identified material of this species shows its distribution to be restricted to the Atlantic Ocean and Mediterranean Sea.

MATERIAL EXAMINED: One specimen dredged in 400 fms., bottom depth 500 fms., off St. Raphael, bearing S. S. E., distance 9 miles, south of France, Mediterranean Sea, by the *"Ara."*

COLOR: Clear lacquer red, much darker and with decided bluish reflections on the carapace. Flecks of deeper crimson the scaphocerite and basal portion of caudal fan. Setae golden, eyes jet black.

DISCUSSION: This is one of the largest and most gorgeously colored members of the genus found in the Atlantic. The largest specimen recorded to date has a length measurement of 90 mm. The type description by Smith, and Kemp's later notes on the extensive series of specimens taken off the Irish coast, give very adequate diagnoses of the species. The single specimen taken by the *"Ara"* agrees with the material figured by these authors.

SYNONYMY.—*Sergestes robustus* S. I. SMITH, Bull. Mus. Comp. Zoöl., vol. 10, p. 97, pl. 16, figs. 5-8, 1882; Rept. U. S. Fish. Comm. for 1882, issued 1884, p. 416, pl. 8, figs. 3-6; *Ibid.* for 1885, issued 1886, p. 697, pl. 20, fig. 6.—HANSEN, Ann. Mag. Nat. Hist., Ser. 7, vol. 11, p. 480, 1903; Crust. Malacostraca Danish Ingolf Exped., p. 83, 1908; Sergestidae, Monaco, Fasc. 64, p. 106, pl. 1, fig. 5, pl. 6, figs. 2t-2z, 1922.—KEMP, Fish. Ireland, Sci. Invest. vol. I, p. 25, pl. 3. See figs. 1-12, 1908.

Sergia robusta ORTMANN, Decap. und Shizopoda der Plankton Exped., p. 38, 1893.

Sergestes inermis HANSEN, *ibid.*, 1903, p. 479, figs. 1 and 5.

Sergestes vigilax Stimpson.

Plate 42.

TYPE: Stimpson's type was a very large mastigopus stage specimen from the Azores.

MATERIAL EXAMINED: Two specimens, dredged 38 miles E. ½ S. E. of Cape Spartivento, Sardinia, in 325 fms., July 22, 1927, by the *"Ara."*

COLOR: This species is creamy white, except on the upper part of the carapace which is translucent rose color. The delicacy of shading is indescribably exquisite.

Discussion: A very fine description of the species, both its adult and mastigopus stages, is given by Dr. Hansen in his report on the Sergestidae, Campagnes des yachts Hirondelle et Princess Alice, 1885-1915.

Distribution: This species is known throughout the Atlantic Ocean, the Mediterranean Sea and the Adriatic Sea; also from the Indian Ocean.

Synonymy.—*Sergestes vigilax* W. Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 45.—A. Ortmann, Ergebnisse der Plankton Exped. der Humboldt-Stiftung, Bd. II, p. 36, 1893.—H. J. Hansen, Proc. Zoöl. Soc. London, pp. 962 and 964, 1896; Crust. Decap. (Sergestides) provenant des Campagnes des Yachts Hirondelle et Princess Alice, 1885-1915; Res. Campagnes Sci. Monaco, fasc. LXIV, p. 159, 1922; pl. 1, fig. 8, pl. 9, figs. 4a-4m, pl. 10, figs. 1a-1c.—A. Senna, Bull. Soc. Entom. Italiana, anno 34, IV, 1902, p. 287, figs. 4-5, pl. 10, fig. 15, pl. 11, figs. 1-12, pl. 12, figs. 1-14, issued 1903.—O. Pesta, Zoöl. Anzeiger Bd. XLII, p. 405, figs. 3 and 5, 1913; Sitzungber. Akad. Wiss. Wien Bd. 123, Abth. I, p. 200, figs. 9, 10, 11, 18; Arch. fur Naturgesch. Jahrg., 81, Abth. A. 1, Berlin, 1915, p. 120; Die Decapoden fauna der Adria, p. 56, fig. 16, 1918.—G. Illig, Deutsch. Sudpol. Exped., 1901-1903, Bd. XV, Zoöl. VII, p. 367, fig. 29, 1914.—O. Sund, Results Michael Sars North Atlantic Deep Sea Atlantic Exped., p. 21, figs. 35-38, 1920.

Sergestes parvidens Spence Bates, Rept. Sci. Results Voy. "*Challenger,*" Macrura, vol. 24, p. 409, pl. 74, fig. 3, 1888.

Sergia clausi A. Konig, Denkschr. math. naturv. Kl. Akad. Wiss Wien, Bd. LXII, p. 10, pl. 1, figs. 1-7, 1895.

Sergestes oculatus A. Konig, *op. cit.,* p. 11, pl. 1, fig. 8, pl. 2, figs. 9-11.

Sergia magnifica S. Lo Bianco, Mitt. Zoöl. Staat. Neapel. Bd. XV, p. 434, 1902.

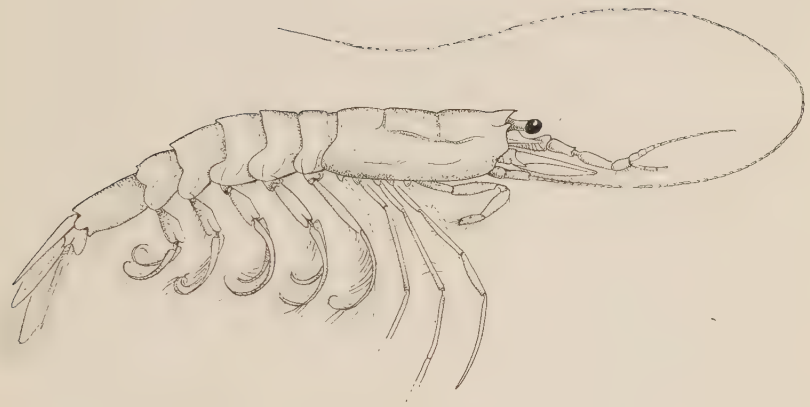
Sergestes clausi J. Thiele, Zoöl. Jahrb. Suppl. VIII, Festchrift. Karl Mobius, p. 465, pl. 16, figs. 43-47, 1905.

Sergestes grandis Sund.

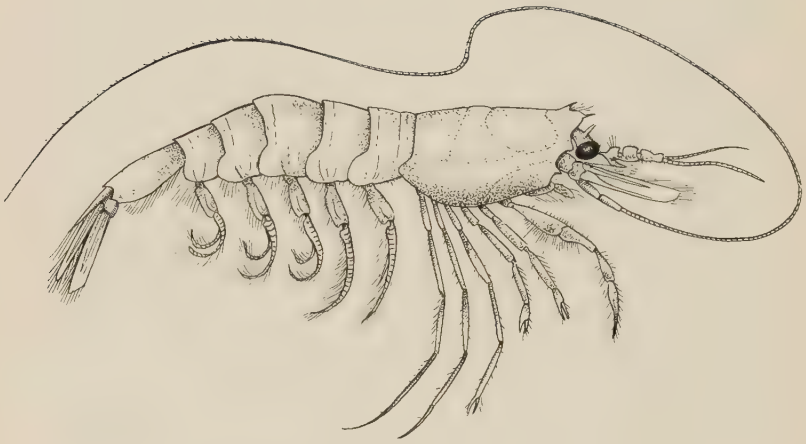
Plate 43.

Type: Taken in the North Atlantic and deposited in the Bergen Museum.

Material examined: One specimen, taken with the dredge down 400 fms., bottom depth 500 fms., St. Raphael, bearing S. S. E., distance 9 miles, south of France, Mediterranean Sea, March 23, 1927.



Sergestes grandis Sund.



Gennadas elegans (S. I. Smith), ×3.

RANGE: Bathypelagic in the Atlantic, off Newfoundland southward to the Sargasso Sea, also off Ireland, the Azores; Mediterranean Sea.

COLOR: In life this species is spectrum red with bright orange markings on the appendages; the setae are golden yellow.

DISCUSSION: The single specimen of *S. grandis* taken by the *"Ara"* fully agrees with Dr. Hansen's exquisite drawings of the species which so thoroughly illustrate the essential anatomy of the species.

SYNONYMY.—*Sergestes grandis* SUND, OSCAR, Rept. Sci. Results Michael Sars North Atlantic Deep Sea Exped. 1910, vol. III, pt. 2, Zoölogy, p. 16, figs. 22-26, 1920, Bergen.—HANSEN, Sergestidae, Res. Campag. Sci. Hirondelle Pr. Alice, Monaco, Fasc. 64, p. 92, pl. V, figs. 3a-n, 1922.

Sergestes bisulcatus T. R. R. STEBBING, Marine Invest. South Africa, vol. 4, p. 87, pl. 24 A, 1905.

Family: LUCIFERIDAE.

Subfamily: Luciferinae.

Genus: LUCIFER J. V. Thompson.

Lucifer orientalis H. J. Hansen.

TYPE: Dr. Hansen founded this species on an extensive series of specimens of both sexes, taken by the *"Siboga"* in the Indo-Pacific, and deposited at the Leyden Museum.

DISTRIBUTION: Known from the Indian and Pacific Oceans.

MATERIAL EXAMINED: A single adult male, found in a bottle of plankton, taken by the *"Ara"* seven miles off Cape Malo, Panama, dredge down 300 fms., March 30, 1926.

DISCUSSION: This specimen is of genuine interest because it establishes the presence of Hansen's species in the tropical American Pacific as well as in the Indo Pacific. The figures given by Hansen for his type apply equally to the present specimen.

SYNONYMY.—*Lucifer orientalis* HANSEN, Siboga Expeditie, Monog. 38, Sergestidae, p. 55, pl. 4, figs. 7 a-g, 1919.

Family: PENAEIDAE.

Subfamily: Aristeinae.

Genus: GENNADAS Bate.

Gennadas elegans (S. I. Smith).

Plate 44

TYPE: Founded upon a series of specimens taken by the *"Blake"* and by the U. S. Fish Commission, in depths ranging from 457 to 1632

fms., at several stations in the western Atlantic between 31° 41′ 0″ N. Lat. and 39° 55′ 0″ N. Lat.; deposited in the Museum of Comparative Zoölogy.

Distribution: Bathypelagic in the North Atlantic on both American and European coasts; also in the Mediterranean Sea.

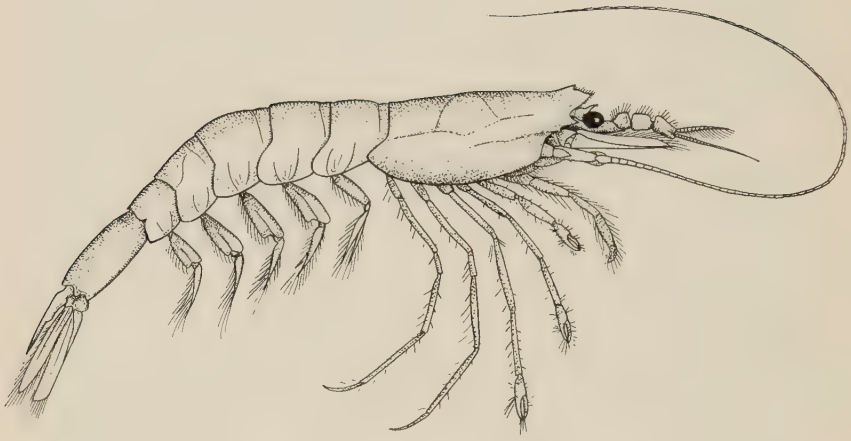
Material examined: Two specimens, dredged in 400 fms., bottom depth 500 fms., St. Raphael, bearing S. S. E., distance 9 miles, south of France, Mediterranean Sea, March 23, 1927, by the *"Ara."*

Color: In life the adults are spectrum red, with purplish-blue markings on the mouth-parts; the preadult stages are less colorful, having only the anterior half of the body red.

Discussion: This species has been fully described by S. I. Smith and more recently by E. L. Bouvier, who has also given us a color-plate of the species. Stanley Kemp's excellent figures, made from specimens taken off Ireland, fully establish the presence of this species on both sides of the Atlantic.

Gennadas elegans is readily distinguished from other members of the genus by: the distance dorsally between the cervical and post-cervical groove is approximately one-sixth of the distance between the postcervical groove and the hinder margin. The antennal angle is prominent, acute; the lower antennal spine is acute with the apex blunted; the branchiostegal spine is small. The second peduncular joint of the antennae is dorsally only half as long as the third joint. The scaphocerite is about three times as long as wide, with the outer margin convex; a subdistal, acute spine which does not extend as far forward as the convex distal margin of the blade. In the second pair of legs the chelae are shorter than the carpus; in the third pair of legs the merus is elongated, a little longer than the carpus, and the chelae are only three-fifths as long as the carpus. The abdominal segments are all smoothly rounded dorsally, except the sixth segment, which is carinated. The thelycum and petasma are also diagnostic. (See figures of these by Kemp.)

Synonymy.—*Amalopeneus elegans* S. I. Smith, Bull. Mus. Comp. Zoöl., vol. X, p. 87, pl. 14, figs. 8-14, pl. 15, figs. 1-5, 1882; Ann. Rept. U. S. Comm. Fish and Fisheries for 1882, p. 399, 1884; Proc. U. S. Nat. Mus., vol. 6, p. 87, 1885; *Ibid.*, vol. VI, p. 189.—A. E. Ortmann, Decap. und Schizopod. der Plankton-Exped., Kiel und Liepzig, p. 27, 1893.—Stebbing, T. R. R., A History of Crustacea, London, p. 219, 1893.—Riggio, G., Monit. Zoöl. Ital., anno XI (suppl.), Roma., p. 19, 1900.—Monticelli, F. S., et



Gennadas clavicarpus De Man, x 3.

Lo Bianco, *Ibid.*, anno XI (suppl.), pp. 20-28, 1900.—Lo Bianco, S., Mith. Zoöl. Stat. Neapel, vol. XV, pp. 149, 420, 422, 423, 435-37, 1902; *Ibid.*, vol. XVI, pp. 119-154 and p. 183; Pelagische Tiefseefischerei der Maia in der Umgebung von Capri, Beitrage zur Kentniss des Meeres und seiner Bewohner, Jena, pp. 29-31, pl. IX, fig. 37, 1904.—Calman, W. E., Ann. and Mag. Nat. Hist., ser. 7, vol. XI, p. 416, 1903.—Riggio, G., Contributo alle carcinologia del Mediterraneo, Natur. Sicil., vol. XVII, pp. 9-18, pl. 1, figs. 13-20, 1905.—Kemp, S. W., Fisheries Ireland, Sic. Invest., 1908, p. 14, pl. 1, figs. 1-16, 1908.

Gennadas brevirostris E. L. Bouvier, C. R. Acad. des Sci., t. CXLI, p. 748.

Gennadas elegans E. L. Bouvier, C. R. Acad. Sci., t. CXL, p. 983; *Ibid.*, t. CXLI, p. 645, 1905; *Ibid.*, t. CXLII, pp. 687-690; *Ibid.*, t. CXLII, p. 748, 1906; Bull. Mus. Oceanogr. de Monaco, No. 55, Monaco, p. 3; *Ibid.*, No. 80, pp. 2 et 9, figs. 6, 11 and 12, 1906; *Ibid.*, No. 93, p. 45, 1907; Revue gen. des Sciences, 17 e annee, No. 11, p. 492, 1906, Paris; Res. Campag, Sci., Monaco, fasc. XXXIII, p. 35, pl. 7, figs. 1-24, 1908.

Gennadas elegans K. Stephensen, Rept. Danish Oceanog. Exped., 1908-10, p. 7, 1923 (with additional synonymy).

Gennadas clavicarpus de Man.

Plate 45.

Type: Deposited in the Leyden Museum.

Distribution: This species has hitherto been known only from the 26 specimens taken by the "*Siboga*" at seven stations in the Indo-Pacific region, *i.e.*, Celebes Sea, Banda Sea, Halmaheira Sea, Manipa Strait, at depths varying from the surface 700 to 2000 meters.

Material examined: Seven specimens dredged in 300 fms., 7 miles S. W. of Cape Malo, Panama.

Technical description: Carapace 9 mm. long, from tip of rostrum to posterior margin. Abdomen 21 mm. long; the rostrum, which projects forward as far as the base of the cornea, is broadly triangular at the base, with an acuminate tip, which points forward; the inferior and superior margins of this tip are convergent and decidedly ciliated; at the hinder of the upper end of the superior rostral margin there is a strong rostral tooth placed 2 mm. behind the acuminate rostral tip; the rostral tooth points upward and the carapace is carinate in the

median line from the rostral tooth to the posterior margin. The gastro-frontal groove is well defined and directed towards the rostral tooth. The cervical and postcervical grooves are also well defined and approach near to each other in the dorsal region. The cardio-branchial ridge is short, neither reaching the postcervical groove anteriorly nor the posterior margin of the carapace posteriorly.

The abdomen has the first three segments moderately robust, the fourth and fifth segments more compressed, diminishing posteriorly; the sixth segment is twice as long as the fifth and is decidedly carinated in the median dorsal line; the carina is rather stout and does not quite attain the posterior margin of the segment. The telson is not quite as long as the sixth abdominal segment and has the dorsal region sulcate; the inferior lateral margins bear three notches and the rudiments of a fourth notch on each side; the tip is armed with a pair of movable spines and several cilia. The peduncle of the rhipidura is well developed; the inner blade is one and two-fifths times as long as the telson, and has the lateral margins very convergent distally, the tip narrow, rounded; a deep sulcus occurs on the proximal inner half of this blade and a very prominent longitudinal ridge approximately in the median line; the outer blade is one-fifth longer than the inner and substantially wider; the outer lateral margin of the outer blade is relatively straight for a distance equal to the length of the inner blade and terminates in a very rudimentary spinule; beyond this spine the lateral margins converge to a rounded apex; this distal portion and the inner lateral margin are finely crenulate and ciliated, as are also the margins of the inner blade. A longitudinal ridge transverses the outer blade, extending diagonally from the median proximal region toward the spinule of the outer lateral margin.

The eyestalk is well developed, slightly flattened dorsally, with a very prominent conical tubercle directed upward. The cornea is subspherical with brownish pigment in the preserved specimen.

The antennulae have the basal article dorsally excavate for the reception of the eye; the spine on the outer lateral margin of this joint is well developed and almost reaches as far forward as the distal margin of the cornea; there is a thin plate-like process from the distal end of the basal article projecting above the eyeball, and fringed with cilia, fan-like. The second antennular article is approximately two-fifths the length of the first and is cylindrical with the dorsal distal end excavate for the reception of the knob-like proximal dorsal end

of the third article, which is nearly one and one-half times as long as the second article and rather bulbous; both the second and third articles are very setiferous on the upper and lateral margins; the biramose flagella have the proximal parts thickened for a distance equal to the length of the last two peduncular articles; the remainder are thin, whip-like.

The antennae have a scaphocerite which is two-thirds as long as the entire carapace, and has the outer lateral margin approximately straight, terminating in a spinule which scarcely at all extends beyond the rounded tip of the blade; the inner lateral margin is not straight but curves gently, sloping toward the rounded apical portion, both of which are crenulate and setose. The greatest width of the scaphocerite occurs at the proximal end and is equal to one-third the length of the scale; the rounded tip of the scale measured across opposite the base of the distal spine is only one-fifth as wide as the basal width.

The external maxillipeds bear a podobranch. The epipodite is slender, about one and one-half times as long as the basipodite is wide. The ischium is three times as long as its greatest width; it is narrowed proximally; the merus is subpyriform, the length being about three-fifths of that of the ischium; the lateral margins are convex and convergent distally; the carpus is four-fifths as long as the merus, narrowed proximally and dilated distally, claviform, its distal or maximum thickness being equal to one-third of its own length; the propodus is approximately as long as the carpus, cylindrical, one-fifth as thick as long; the dactyl, including the apical spine, is five-sixths as long as the propodus, the spine comprising two-fifths of this length. The inner lateral margins of the endognath are furnished with many setae.

The first three pairs of legs are chelate; the last two pairs attenuated, monodactylic.

The thelycum of the adult female corresponds with that figured by Dr. de Man from the type taken by the *"Siboga"* in the Indo-Pacific Ocean.

The thelycum consists of a trapezoidal process, between the third pair of legs; this process is broadest on the basal margin; the lateral margins converge anteriorly, the anterolateral angles are acute; the anterior margin is V-like, deeply emarginate in the middle; between the fourth pair of legs there are two plates, the anterior of which is produced forward A-like in the middle and correspondingly emarginate on the posterior margin; the anterior plate is not so wide as

the posterior one; the latter is also produced on the anterior margin to a broad triangulation but not emarginate posteriorly. Between the fifth legs there is a flattish narrow plate, with the anterior margin rounded, the posterior margin also rounded but with a narrow emargination in the median line; this plate is one and two-fifths times as long as broad.

The adult male petasma likewise corresponds to that of the type described and figured by Dr. de Man from the Indo-Pacific.

The petasma, viewed from the anterior side, consists of two laminae which meet along the median line for the proximal half of their length, then are produced into a rounded, denticled process, which is directed inward and in contact with its companion of the other plate; beyond this the median lines are also denticled, diverge, and the distal margin of this area terminates in a rather bluntly rounded small lobe, which is less than half the length of the larger overshadowing lobe. This larger lobe is rather broadly rounded, slightly concave on the anterior lateral face and correspondingly rounded on the posterior lateral face; there is a small tooth-like lobule adjacent to the large lobe on the outer side near its base; there is a large pointed tooth outside the lobe but not quite so long; this tooth is very acuminate, with the tip curved forward and outward; outside of this there is a second larger tooth with the lateral margins rounded, the tip briefly acuminate and forward-directed; on the anterior side of the inner lateral margin of this tooth there is a small tooth-like lobule; beyond the tooth and below it there is on the posterior face a rounded, semi-fused lobe which lays upon the proximal part of the outer teeth and is visible through it. There is also a long narrow, V-like process on the anterior face of each half of the petasma near the middle of the inner lateral margin and with the apex of the process directed inward.

SYNONYMY.—*Gennadas clavicarpus* DE MAN, *"Siboga"* Exped. Mon., 39a, pt. I, family *Penaeidae,* p. 19, 1911 (text), pls. 1 and 2, figs. 3-3k, 1913 (plates); *Ibid.,* Mon., 39a[4], part 5, p. 3, pl. 1, fig. 1, 1922.

Family: HOPLOPHORIDAE.

Genus: ACANTHEPHYRA A. Milne Edwards.

Acanthepyra purpurea A. Milne Edwards.

Color plate in Mr. Vanderbilt's "To The Galapagos on the *'Ara'.*"

TYPE: Milne Edwards' type was collected by "Travailleur" in the Antilles, at a great depth, and is deposited in the Paris Museum.

MATERIAL EXAMINED: One specimen taken off Cape Malo, Panama, in 300 fathoms, March, 1928, by the *"Ara."*

DISTRIBUTION: This species is widely distributed in the bathypelagic fauna of the Atlantic, Pacific and Indian Oceans. It has been abundantly taken on both sides of the north Atlantic, as far north as Davis Strait and Iceland, also in the Antarctic by the *"Challenger"* and the German South Polar Expedition and by several expeditions in the tropical and south Atlantic. It was taken by the Percy Sladen Trust Expedition in the southern parts of the Indian Ocean. The *"Challenger"* took it in the Indian Archipelago, also the coasts of Australia, New Zealand, the Kermadec Islands and Japan. It was taken not by the *"Endeavour."* The *"Siboga"* took nine specimens in the Indo-Pacific, at five stations. Two specimens were taken by the *"Albatross"* in the Gulf of Panama. It has also been taken in the Mediterrranean Sea and the Adriatic, and according to Dr. DeMan, the *A. batei* taken off Cape Lighthouse, South Africa, is also *A. purpurea.*

COLOR: Spectrum red.

TECHNICAL DESCRIPTION: The rostrum is four-fifths as long as the carapace and is armed on the superior margin with eight, not quite regularly, distributed spines in addition to the apical spine, and five subequally spaced spines on the inferior margin; the rostrum is moderately upcurved. There is a sharp median, longitudinal carina on the second to sixth segments, inclusive, that on the second segment extends only the posterior two-thirds of its length, while those on the third, fourth, fifth and sixth segments each terminate posteriorly in a sharp tooth, that of the third segment being decidedly the longest, the sixth next, and the third and fourth spines quite small. The telson is long, slender, dorsally truncate proximally and slightly excavate, distally; there are seven submarginal pairs of spines along the lateral border, the last two pairs being terminal. The rhipidura is distinctly shorter than the telson.

The ocular peduncle is short, dilated distally and with a blunt tubercle on the inner distal margin; the cornea is pyriform, of greater diameter than the peduncle and composed of many quite small hexagonal facets.

The inner antennae have the basal peduncular article deeply excavate for the reception of the eye and fringed heavily on the margins

surrounding the eye; the flagellum is biramose, the outer branch having a distinctive, fleshy proximal portion.

The external antennae have the basal peduncular article produced to a sharp triangulate point on the external inferior distal angle; the flagellum is quite as long as the animal's body; the scaphocerite is triangular and almost as long as the rostrum and has a deep submedian longitudinal groove; the inner margin is crenulate and heavily fringed; the outer half of the distal margin is an apical spine.

The legs have both lateral margins heavily fringed with long, plumose setae; the first and second pairs of legs are weakly chelate, subequal, each being nearly as long as the third pair of legs; the third, fourth and fifth pairs of legs are subequal, slender but robust; the dactyli are spinulose. The basecphyses are long, multiarticulate, plumose.

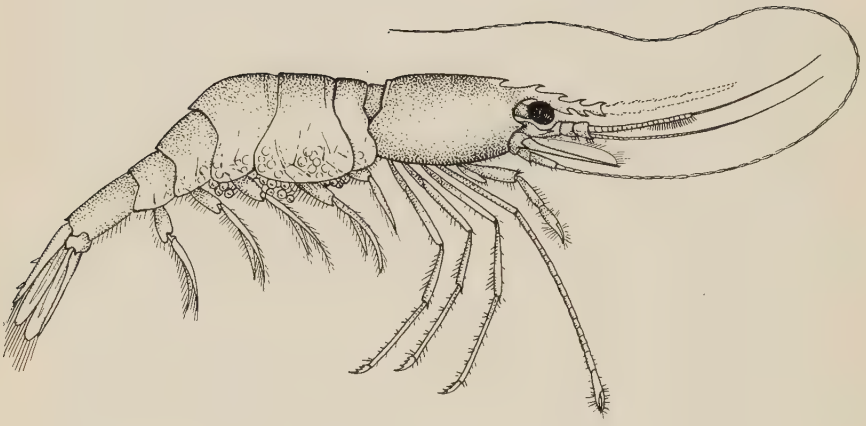
The stylambes of the inner branches of the pleopoda are slender, oval, with the margins crenulate and heavily setiferous.

The rostral formulae varies; detailed discussion of this variation as shown in a large series of specimens taken by the *"Arcturus"* is given in my report of the Pacific Deep-Sea Crustacea of that Expedition.

SYNONYMY.—*Acanthephyra purpurea* A. MILNE EDWARDS, Compt. Rend. Acad. Sci., Paris, t. XCIII, p. 935, 1881.—STANLEY W. KEMP, Fisheries, Ireland, Sci. Invest., vol. 1, p. 4, pls. 1 and 2, figs. 1-3, 1904 (issued 1905). Synonymy; *idem* for 1908, vol. 1, pp. 56-58, 1910; Trans. Linn. Soc. London, 2nd ser., Zoöl., vol. 16, pt. 1, p. 64, 1913.—H. J. HANSEN, Danish Ingolf Exped., vol. III, 2 Crust. Malacost. I, Copenhagen, p. 75, 1908.—K. STEPHENSEN, Vidensk. Meddel. fra den Naturh. Foren., vol. 64, pp. 64 and 329, 1912; Rept. Danish Oceanog. Exped. 1908-1910 to the Mediterranean and Adjacent Seas, vol. II, Biology D 3, Decap.-Macrura, p. 67, 1923.—O. PESTA, Zoöl, Anz., vol. 42, p. 70, 1913.—LENZ and STRUNCK, Deutsch Sud-Polar Exped. 1901-03, vol. 15, Zoöl. VII, Berlin, 1914, p. 326.—DEMAN, Siboga Expeditie, Mon. 39A 3, p. 57, pl. 6, figs. 12-12c, 1920.

Acanthepyra parva H. COUTIÈRE, Bull. Musee Oceanogr. de Monaco, 1905, p. 15, fig. 5.

Acanthephyra purpureus T. R. R. STEBBING, Ann. South African Museum, vol. 15, pt. 2, p. 96, 1915.



Systellaspis debilis (A. Milne Edwards), ×1.5.

Genus: **SYSTELLASPIS** Spence Bate.

Systellaspis debilis (A. Milne Edwards).

Plate 46.

TYPE: The type was collected in 500 fathoms in the Bahama Channel, and is deposited in the Paris Museum.

DISTRIBUTION: Rather widely distributed in the bathypelagic Atlantic; also once recorded from the Pacific, in the vicinity of Kauai Island, Hawaiian Islands, and a subspecies, variety *indica* deMan, taken by the *"Siboga"* in the Halmaheira Sea at 798 meters. The Atlantic records include four specimens taken between New York and the West Indies, one record south of Iceland; numerous specimens taken by the *"Thor"* in the northeast Atlantic and by the *"Helga"* in the Atlantic through the area ranging from the Faröes to the Bay of Biscay, also in the mouth of the English Channel, and off the coasts of Brittany, also west of the Cape Verde Islands and in the South Atlantic, at Lat. 35° 39′ S., Long. 8° 16′ W.

MATERIAL EXAMINED: Two females dredged in 150 fathoms, seven miles off Alligator Reef, March 20, 1926, by the *"Ara."*

TECHNICAL DESCRIPTION: Female. Rostrum broken off about midway its length, body angulated behind the third abdominal segment. Carapace, from the orbital angle to posterior margin 9.5 mm. long; abdomen, including telson, about 33 mm. long. Rostrum (broken) slightly arched above the orbit, thence deflected briefly and with the distal portion apparently directed upward.

The rostral carina is continuous onto the carapace for about half the length of the latter, and with a dorsal median gastric spine near its posterior end. The broken rostrum bears three spines on its upper surface, one above the orbital angle, the remaining two, anterior to this and subequally spaced. The lower margin has two spines, the hinder of which is about in line with the most anteriar of the spines on the upper margin. The carapace is smooth with a sharp spine at the upper antennal angle. The abdomen has the first segment shorter than the second; the third segment, produced, one and one-half times as long in the median line as the second segment; the fourth segment slightly longer than the second segment; the fifth segment about three-fourths as long as the fourth; the sixth segment is about twice as long as the fifth; the telson is about as long as the sixth segment, tapering with a brief, truncated apex which is armed with a pair of long, acute, articulated spines, and the dorsal surface is armed with

two submedian pairs of articulated short spines. The epimeral plates of the first, second and third segments are broadly rounded, that of the second segment being subcircular and overlapping both adjacent segments; the epimeral plates of the fourth and fifth segments are less deep and more posteriorly directed. The caudal fan has a brief peduncular article, and an elongate-ovate inner blade which is a trifle longer than the telson; the outer blade is a little wider and longer than the inner and has a subdistal tooth on the outer lateral margin. Both blades have a median longitudinal rib and ciliated margins.

The eye is set on a short, flexible, slender stalk; the cornea terminal, spherical, large, with a large ocellus on the dorsal surface.

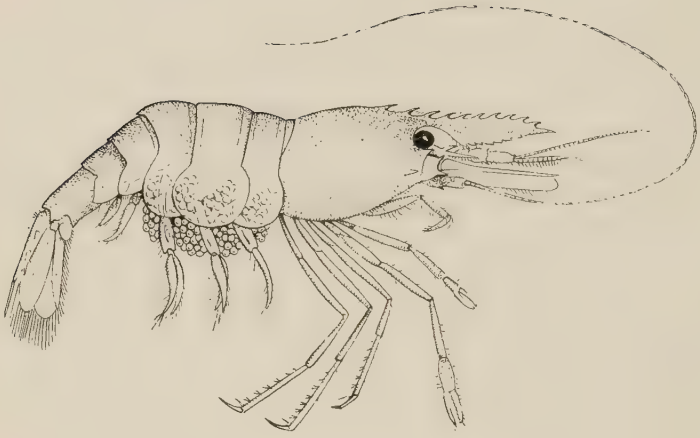
The antennulae have the basal article excavate beneath the eye with a lanceolate process on the outer lateral margin; the second article is short, cylindrical; the third article shorter, but similar, and giving rise to a thick coarse ring at the base of the long, outer flagellum, which is broken off after the third ring, and a slenderer and longer article at the base of the inner whip, which is broken off after the thirtieth annulation.

The antennae have a short basal article with a small, acute spine on the outer distal angle; the second and third articles are slender, cylindrical; the third, one and one-half times as long as the second and reaching about two-fifths of the length of the scaphocerite, which is exactly as long in the present specimen as the carapace is from the orbital angle to its posterior margin; the scaphocerite has its outer margin thickened, terminating distally in an acute tooth; the distal margin is unequally convex, the inner lateral margin being the longer, and consequently the inner half of the distal margin is less deeply rounded than is the other half. The flagellum is multiarticulate, in the present specimen being about one and one-half times the length of the body.

The first legs are slender, yet moderately robust in comparison with the remaining pairs; the merus is elongated; the carpus slender, about two-fifths as long as the merus, and the propodus has the palm about three-fourths as long as the palm, the tips acuminate and set with a tuft of bristles.

The second legs are very long and slender, with a multiarticulate carpus composed of about sixteen articles, of which the distal article is twice as long as any of the others and has a weak chela.

The third, fourth and fifth pairs of legs are similar, long, slender,



Leander tenuicornis (Say), × 3.2.

each with many bristles; the dactyl short, curved, with a bifid tip and a series of three or four spines along the inferior lateral margin.

SYNONYMY.—*Acanthephyra debilis* A. MILNE EDWARDS, Compt. Rend., XCIII, p. 13, 1881; Recueil de figs. de Crust., pl. 33, fig. 2, 1883. —FAXON, Bull. Mus. Comp. Zoöl., vol. 30, p. 162, 1896.—T. RICHARD, Bull. Mus. Oceanog. Monaco, No. 41, p. 17, 1905.—STANLEY KEMP, Fish. Ireland, Sci. Invest., 1905 (issued 1907), p. 16; *ibid,* 1908, p. 59, pl. 6, figs. 1-15.

Miersia gracilis SMITH, Bull. Mus. Comp. Zoöl., vol. 10, p. 70, pl. 11, fig. 4, 1882.

Systellaspis debilis COUTIÈRE, Bull. Mus. Oceanog. Monaco, No. 48, p. 5, fig. 2, 1905; *ibid,* No. 70, 1906, figs. 1-4, development.—K. STEPHENSEN, Rept. Danish Oceanog. Exped. 1908-1910, issued Aug., 1923, p. 54.

S. debilis, variety *indica* DEMAN, Mon. Siboga Expeditie, Mon. 39A3, p. 51, pl. 6, figs. 11-11f, 1920.

Systellaspis bouvieri COUTIÈRE, *ibid,* No. 48, p. 8, fig. 3, 1905.

Acanthephyrs gracilis HANSEN, Crust. Malacostraca, Danish Ingolf Exped., vol. 3, part 2, p. 76, 1908.

Family: PALAEMONIDAE.

Genus: **LEANDER** Desmarest.

Leander tenuicornis (Say).

Plate 47.

TYPE: Say's type came from the "Banks of Newfoundland" and consisted of two specimens, one of which was deposited in his personal cabinet, the other in the Academy of Natural Sciences of Philadelphia, where it still is in good condition.

DISTRIBUTION: Abundant in the Southern United States, the West Indian region as far south as the mouth of the Amazon, in Brazil; also common in the "Sargasso Sea," pelagic in the seaweed. More rarely found in the northern waters adjacent of the path of the Gulf Stream, by which it has been swept from its normal habitat.

MATERIAL EXAMINED: Two specimens, one of which is ovigerous, taken in Sargasso, on the south coast of Cuba, February, 1923, by the *"Ara."* One, Turtle Harbor, Florida, 2½ fms., April 28, 1926. Three, Hogsty Key, San Salvador, B. W. I.

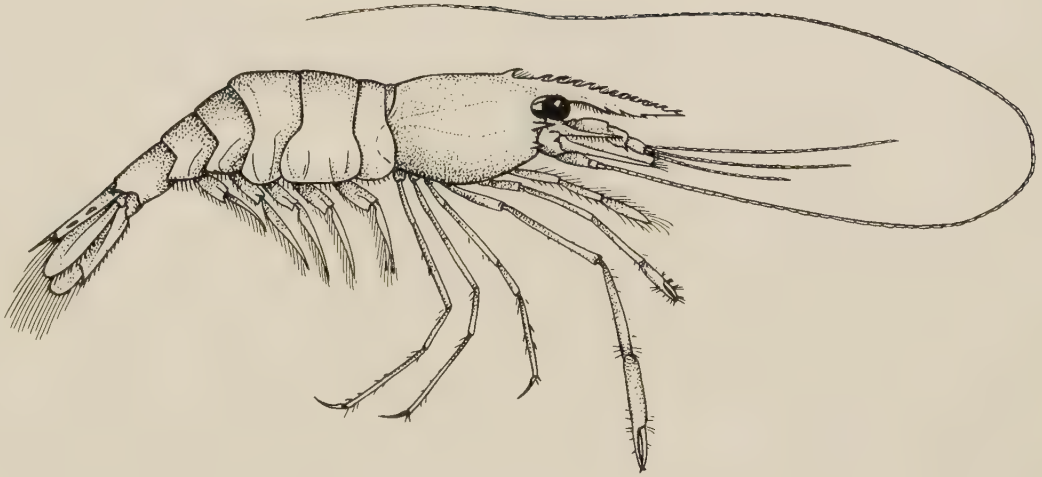
TECHNICAL DESCRIPTION: Animal small, usually an inch or less in length; in color, the living animal imitates the yellowish, blotched tones of the seaweed. Rostrum about as long as the carapace, directed

straight forward, with the anterior half of the upper margin more convex than the proximal, forming a crest, the entire dorsal margin armed with a series of eight to ten teeth, the posterior two of which are on the carapace posterior to the orbital angle; there is a strong lateral carina on the rostrum; the lower margin is convex, widest just in advance of the eye, armed with six or seven acute teeth with a dense fringe of cilia interspersed between the teeth. The carapace is short and robust, its length scarcely exceeding its height, with a well developed postorbital spine, none at the antennal angle of the margin, but one on the carapace subdistal to the margin, behind the antenna. The rostral carina is continuous on the carapace for nearly half its length. The abdomen is robust, the last four segments flexed downward, nearly at a right angle to the remainder of the body. The first, second and third segments have the epimeral plates much developed, with rounded margins. On the fourth and fifth segments the lateral margins are much less produced; the sixth segment is only a little longer than the fifth; the telson is one and one-half times as long as the sixth segment, tapering, with a submedian pair of longitudinal carinae, from which there arise two pairs of articulated spines; besides these, there is, at the apex of the telson, a pair of long, articulated spines, placed one on each side of the apex and extending beyond it. The caudal fan is well developed, margins ciliated; both blades oval, the outer one wider than the inner and with a subdistal spine on the outer lateral margin.

The eye is terminal, placed on a well developed, articulated stalk; the cornea bulbous, with a strong ocellus on the dorsal surface.

The antennulae have the basal article flattened below the eye, the outer lateral margin thickened in a ridge, which terminates distally in a long, acute spine that reaches almost to the distal margin of the second segment, which is small, cylindrical; the third article is subequal to the second; the flagellum is triramose, the shortest branch being about half an inch long, thick, setose; the intermediate branch quite twice the length of the short one, and the longest branch quite four times the length of the shortest and very slender.

The antennae have a stocky peduncular article, the upper and lower outer dorsal angles toothed; the second and third articles stocky, short, the whip slender, about as long as the body of the animal. The scaphocerite reaches as far forward as the rostrum and has the distal margin evenly convex and ciliated, a subdistal tooth



Leander squilla (Linné), ×1.5.

on the outer side at the termination of the thickened outer lateral margin.

The first legs have the fingers longer than the palm; in the larger second legs the fingers are about equal in length to the palm. The third, fourth and fifth pairs of legs are monodactyl, each with the propodus greatly elongated and furnished on the inner lateral margin with a series of tufts of exceedingly stiff bristles; the dactyl is about one-third the length of the propodus, curved, acuminate.

Synonymy.—*Palaemon tenuicornis* Say, Journ. Acad. Nat. Sci. Phila., vol. I, p. 249, 1818.—Hay and Shore, Bull. U. S. Fish. Bur., vol. 35, p. 392, pl. 27, fig. 6, 1918.

Palemon tenuirostre H. Milne Edwards, Hist. Nat. Crust., vol. II, p. 393, 1837.

Palaemon tenuirostris Spence Bate, Rept. Voy. *"Challenger,"* Zoöl., vol. 24, p. 784, 1888.

Palaemon natator H. Milne Edwards, *op. cit.*, p. 393.

Palaemon natator Goodsir, Ann. and Mag. Nat. Hist., vol. XV, p. 74, pl. vii, fig. 3, 1845.—White, List Crust. Brit. Mus., p. 77, 1847.—Dana, U. S. Explor. Exped. Crust., p. 588, 1852; Atlas, pl. 38, figs. 11-11a, 1855.—Heller, Crust. Sudl. Europe, p. 268, pl. 9, figs. 11, 12, 1863.—Spence Bate, *op. cit.*, vol. 24, p. 784, pl. 128, figs. 6 and 7, 1888.

Leander erraticus Desmarest, Ann. Soc. Entom. de France, ser. II, vol. 7, p. 92, text fig., 1849.

Leander natator Stimpson, Proc. Acad. Nat. Sci. Phila., p. 40, 1860.

Leander tenuicornis Kingsley, Bull. Essex Inst., vol. X, p. 66, 1878.—S. I. Smith, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 122, 1879.—Rankin, Ann. New York Acad. Sci., vol. 12, p. 538, 1900.—Stebbing, Trans. Royal Soc. Edinburgh, vol. 1, pt. 2, No. 9, p. 288, 1914.—Verrill, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 143, pl. 43, figs. 4, 4a, 1922.

Pandalus tenuicornis Rankin, Ann. N. Y. Acad. Sci., vol. 12, p. 544, 1900. (Error for *Palaemon.*)

Leander squilla (Linné).

Plate 48.

Type: Linnaeus' type came from the Scandinavian coast.

Distribution: Known from the west and southern coasts of the Scandinavian peninsula, Denmark, the British Isles, the northern coasts of France, the Hispanic Peninsula, the Mediterranean and Adriatic Seas, the Black Sea, the Azores, the Canary Isles, Madeira

and the Cape Verde Islands. Littoral to 30 fms. The *"Ara"* specimen is the first specific record from Morocco.

MATERIAL EXAMINED: One specimen, dredged in 11 fms., Casa Blanca, Morocco, August 20, 1926, by the *"Ara."*

TECHNICAL DESCRIPTION: Animal two to two and a half inches long. Rostrum directed slightly upwards distally, tip bifid; ventral margin normally armed with three teeth; dorsal margin armed with seven to ten teeth in addition to the bifid apex; these teeth distributed as shown in the plate, the last two on the carapace and the next one above the orbit. The shorter branch of the outer antennule is fused with the longer branch for about two-fifths of its length; the three flagella have the relative lengths shown in the figure. The scaphocerite is widest proximally and extends a little beyond the antennular peduncle; the flagellum is about one and two-thirds times the body length. The palp of the mandibles is two-jointed.

The first pair of legs extend beyond the tip of the scaphocerite.

The second pair of legs are much stronger and extend beyond the tip of the scaphocerite by about one-half to three-fifths of the length of the carpus and the entire length of the propodus. The propodus is slightly longer than the carpus; the fingers are nearly equal to the palm.

The coloration of the species, which is marbled, is said to be quite variable, usually resembling that of its environment.

SYNONYMY.—*Cancer squilla* OLIVI, Zool. Adriatica, Cat. Anim. Golfo Venezia. 1792, p. 49.

Palaemon squilla BELL, British Stalk-eyed Crust., p. 305 and text fig., 1853.

Leander squilla SENNA, Bull. Soc. Entom. Ital., Ann. XXIV, 1903 (and extensive synonymy).—KEMP, Sci. Invest. Fish. Ireland, I, 1908, p. 132, pl. XX, fig. 3 a-e (1910).

Genus: MACROBRACHIUM Bate.

Macrobrachium acanthurus (Wiegmann).

Plate 49.

NAME: Velvet fingered fresh water shrimp.

TYPE: Collected on the coasts of Brazil, in fresh water, and deposited in the Berlin Museum.

DISTRIBUTION: An inhabitant of fresh water streams from the Rio Grande, Texas, to the Rio Grande du Sul, Brazil; also found in Ecuador.

Macrobrachium acanthurus (Wiegmann).

MATERIAL EXAMINED: Three large specimens from Havana, Cuba, March 27, 1926, taken by the *"Ara."*

COLOR: Mr. Vanderbilt's field notes state that this shrimp is "slaty olive-grey in color when alive."

TECHNICAL DESCRIPTION: Carapace robust, comprising exactly one-third of body-length, exclusive of rostrum; rostrum beyond the carapace two-fifths as long as the carapace, continued posteriorly for one-third the length of the carapace, armed on the upper surface with nine teeth, the most posterior one of which is well back on the carapace and twice as far from the next tooth as the latter is from the next tooth; the eighth and ninth teeth are very close to each other, and the ninth tooth is very close to the apex of the rostrum, which is acute and forward-directed. There are five weaker but well developed teeth on the inferior rostral margin, subequally spaced along the convex median portion of the rostrum. There is an approximately median longitudinal carina on each lateral face of the rostrum, which is continuous posteriorly with the orbital margin. The antennal spine is short, acute, and a short distance posterior to it on the carapace there is another acute spine, in line with and subequal to the first antennal spine. A light, short groove runs obliquely just below these two spines for one-third the length of the carapace. The lateral and posterior margins are carinate.

The abdomen is robust, moderately compressed laterally. The six segments and caudal fan have about the same proportions and contour as do those of *M. olfersi* and *M. jamaicense.*

The eyes are of moderate size, spherical, terminal, black; the cornea of slightly greater diameter than the stalk.

The inner antennae have the basal article longer than the eye, excavate beneath the eye; the outer lateral margin thickened and terminating subdistally in an acute spine; the second and third articles are short, cylindrical, successively narrower; the second article is ciliated along both lower margins. The flagellum is two-branched, the inner whip single, multiarticulate, 140 mm. long; the outer whip biramose, its outer branch being the longest and thickest, 156 mm. long; the shorter whip is only two-fifths as long as the associated one. The external antennae have the proximal joint short, strong, with an acute spine at the outer distal angle; the scaphocerite is a little longer than the rostrum and has the outer lateral margin thickened and armed distally with an acute spine; the distal margin is widely, evenly rounded and ciliate and the inner margin is also

ciliate; the second and third articles are also short, cylindrical and lie beneath the scaphocerite, extending about one-third its length; the flagellum is 200 mm. long, multiarticulate and extends beyond the extended chelipeds.

The external maxillipeds are slender, leg-like, arched, well separated.

The first legs are small, slender; the basis and ischium rather thick and with many small bristles; the merus is twice the length of the ischium and slenderer; the carpus is one and one-half times as long as the merus and slenderer; the propodus is short and weak, being only two-fifths as long as the carpus; the fingers comprising one-half this length and being slender, subequal, setose.

The chelate second legs are equal, each measuring 190 mm. long and being slender, cylindrical, the ischium not quite one-half the length of the merus; the merus is 37 mm. long; the carpus 54 mm. long; the propodus including the fingers is 77 mm. long; the fingers are subequal, each 32 mm. long, subcylindrical, with the tips decidedly upcurved. The ischium, merus, carpus and palm of the propodus are set all over with rows of sharp corneous spines; the fingers are entirely covered with a fine velvety pubescence.

The third, fourth and fifth legs are slender, subequal, proportioned about as in *M. olfersi,* the propodus about three times as long as the dactyl and armed along its inferior lateral margin with a row of spinules.

SYNONYMY.—*Palaemon acanthurus* A. F. A. WIEGMANN, Archiv. f. Naturg., vol. 2, S. 150, 1836.—A. E. ORTMANN, Zoöl. Jahrb. V. Abth. f. Syst., p. 720, taf. 47, fig. 5, 1890.

Palaemon forceps H. MILNE EDWARDS, Hist. Nat. Crust., vol. 2, p. 397, 1837.—H. DESAUSSURE, Mem. Hist. Nat. du Méxique des Antilles et des Etats Unis, re livre, p. 51, 1858.—E. VON MARTENS, Archiv. f. Naturg., vol. 35, Jahrb. 1869, S. 28, taf. 2, fig. 4.—S. I. SMITH, Trans. Conn. Acad. Arts and Sci., vol. 2, p. 24, 1869.

Palaemon (Eupalaemon) acanthurus J. G. DEMAN, Ann. Soc. Roy. Zoöl. et Malcol. de Belgiqué, vol. 46, p. 243, 1911.

Macrobrachium olfersii (Wiegmann).

Plate 50.

DIAGNOSTIC CHARACTERS: In the field this species is readily distinguished from all its associates by the vivid purplish-blue of the great cheliped. The fact that this hand is dilated, covered with numer-

Macrobrachium olfersii Wiegmann, natural size.

ous spines and with a tuft or brush of setae on its upper face, serves to distinguish it from all other members of the genus.

TYPE: Collected on the coasts of Brazil by a Mr. Olfers, and deposited in the Berlin Museum.

MATERIAL EXAMINED: One specimen taken in a fresh water stream emptying into Chatham Bay, Cocos Island, Pacific Ocean, March 5, 1926, by the *"Ara."*

COLOR: According to the color-plate made by Mr. Belanske, the pair of large chelipeds are deep gentian blue with a purplish cast; the body and other appendages are mottled reddish-brown, the tips of the antennae and pleopoda being yellowish. The plate has been published by Mr. Vanderbilt, in his "To the Galapagos on the *'Ara'*."

TECHNICAL DESCRIPTION: Carapace exclusive of rostrum equal to two-fifths of entire body length. Abdomen tapering, convex, laterally compressed. Rostrum short, extending about as far forward as the antennular peduncle and continued backward on the carapace two-fifths of its length, tip acute, upper margin armed with 16 spines, acute, forward-directed, with 8 to 12 stiff, upstanding bristles on the proximal upper margin of each spine. The tip of the spine is translucent, horn-color. There are 2 similar spines on the inferior rostral margin. There is a median longitudinal carina on the lateral face of the rostrum, which carina is posteriorly continuous with the concave ocular margin. The antennal spine is conical, short, acute. Behind and slightly below it on the carapace is another smaller spine. The surface of the carapace is smooth, dotted with numerous coarse punctae, a single depression, scarcely a groove, occurs on each side, just below the antennal spine, and extends backward two-fifths the length of the carapace. The lower lateral parts of the carapace are closely appressed to the underside of the body, the lateral margin carinate.

The first abdominal segment is only two-thirds as long in the median line as the second segment, and has its lateral margin rounded and posteriorly concealed by the overlapping of the second segment, which laterally is produced into a large, subcircular plate which posteriorly overlaps the third segment; the third segment is as long as the second and has its lateral margin rounded but not produced; the fourth and fifth segments are subequal, each two-thirds as long in the median line as the third segment and with the posterior margin notched in the upper lateral region, and thence obliquely produced to the postlateral angle which is nearly right-angled, slightly rounded; the sixth segment is one and one-half times as long

as the fifth and has the posterior margin straight in the median region, produced to a triangular process which projects over the lateral part of the telson and is concavely excavate outside this triangle, above the base of the uropod. The telson is only one and one-third times as long as the sixth segment, triangulate, convex on the dorsal surface and armed with two, submedian pairs of short, articulated spines, the first of which is placed about not quite midway the telson, the distal pair being halfway between the first pair and the apex of the telson, which is triangulate, armed at each side with two articulated spines, the inner of which is the longer and with a dense brush of long, plumose setae. The uropoda have the basal article small, notched medially in the distal margin; the blades are of equal length, both extending beyond the telson and of an oval shape, the inner blade being slightly narrower than the outer; the outer blade has the distal third separately articulated and a tooth on the outer lateral margin of the proximal article. Both blades are fringed with long, stiff, close-set setae.

The eyes are close-set, spherical; the stalk short, the cornea terminal, black.

The inner antennae have the basal article excavate beneath the eye and extending slightly beyond the eye, with the lateral and distal margins ciliate; the second and third articles are short, cylindrical, distally ciliate on the upper margin; the flagellum is composed of a single inner whip, consisting of fifty rings, and a biramose outer whip, the longer, thicker branch of which is subequal to the inner whip and consists of many rings; the shorter branch of this biramose flagellum is very short.

The external antennae have the basal article short, with an acute spine at the lower, outer distal angle; the scaphocerite is oval, extending beyond the peduncle of the inner antennae as far as the tenth ring of the flagellum. There is a longitudinal groove paralleling and near the outer lateral margin of the scaphocerite, which terminates subdistally at the acute tooth on the outer lateral margin; the distal margin is broadly rounded and ciliated; the second and third peduncular articles are short and are concealed beneath the scaphocerite; the flagellum is stocky.

The external maxillipeds are slender, leg-like, elongated and bristling with stiff setae.

The first legs are small, slender, when extended, reaching to beyond the scaphocerite for half its length. The merus and carpus are very

slender, elongated subequal, the propodus is scarcely two-thirds as long as the carpus and has the palm slightly swollen; the fingers subequal, almost as long as the palm, rounded, with the entire cutting edges meeting, the tips rounded, and set with clusters of bristles.

The second chelipeds are greatly enlarged and are unequal, the left being much the larger. It is as long as the entire body. The basis is strong, the ischium triangulate, wider distally and armed along the anterior lateral margin with a double row of corneous spines; the merus is long and very swollen, especially on the anterior margin where the spines are longest and most prominent; the carpus is three-fifths as long as the merus, small proximally and swollen distally, also with the spines longest and sharpest on the anterior side; the propodus is as long as the carapace, including the rostrum; the palm occupying three-fifths of this length and being much swollen, its height equal to three-fifths of its length, the upper lateral margin armed with a double row or comb of corneous spines, below which the upper half of the outer surface of the palm is free of spines, but is covered by an elliptical patch of dense setae; the remaining outer surface being covered with rows of long, conical, corneous tipped spines, which are also present on both fingers. The claw is so bent that the fixed or propodal finger appears to be on the upper side, while the hinged finger is on the outer, lower side; the fixed finger is the shorter and is relatively straight, except for the curved tip; it is also thicker than the hinged finger which is slender, curved, its tip crossing that of the fixed finger. There is an elliptical gap between the fingers, which is practically filled by a dense brush of setae from the cutting edges of both fingers. The weaker second chela is similarly proportioned to the larger one, but is much less swollen, and its spines, although corneous, are very small; the fingers are quite as long, or even a little longer than the palm.

The third, fourth and fifth pairs of legs are slender and set with numerous stiff bristles; the ischium is three-fifths as long as the merus; the carpus as long as the ischium; the propodus the longest joint of the series, being a trifle longer than the merus, and armed along its inferior lateral margin with a row of corneous spines; the dactyl is short, only one-fourth as long as the propodus, acuminate and setose.

Synonymy.—*Palaemon olfersi* Wiegmann, Archiv. f. Naturg., vol. 2, part 1, p. 150, 1836.—Greeff, in Sitzungber. Gesells. zur Beforderung ges Naturw. Merburg. 1882, No. 2, p. 30.—Ort-

MANN, Revista do Museu Paulista, No. II, p. 212, Est. 1, figs. 10 and 11, 1897.—AURIVILLUS, Bihang K. Sev. Vet. Akad. Handl. Stockholm, vol. 24, Afd. 4, No. 1, p. 23.

Bithynis olfersi RATHBUN, Proc. U. S. Nat. Mus., vol. 22, p. 316, 1900.—Bull. U. S. Fish. Comm., vol. 20, part 2, p. 24, 1901.

Palaemon (Macrobrachium) olfersi DEMAN, Trans. Linn. Soc. London (2), Zoöl., vol. 9, p. 314, pl. 20, figs. 54-74, 1904.—Ann. Soc. Roy. Zoöl. Malacol. Belgique, vol. 46, p. 109, 1911.—SCHMITT, Bull. Amer. Mus. Nat. Hist., vol. 53, p. 40, 1926.—WILLIAM BEEBE, Arcturus Adventure, 1925, p. 228, appendix p. 435.

Macrobrachium olfersi VAN NAME, in W. K. Vanderbilt's "To the Galapagos on the *'Ara'*."

Macrobrachium jamaicense (Herbst).

Plate 51.

TYPE: Collected in the fresh water streams of Jamaica, and deposited in the Berlin Museum.

DISTRIBUTION: This species is well known in the fresh water fauna of the American tropics on both side of the continents, and has been recorded from Texas, southward, to Brazil on the East Coast, and also from several of the islands of the West Indies, as well as from Lower California to Peru on the West Coast.

MATERIAL EXAMINED: One specimen taken in fresh water stream emptying into Chatham Bay, Cocos Island, Pacific Ocean, January 29, 1928, by the *"Ara."*

TECHNICAL DESCRIPTION: Carapace robust, smooth, slightly more than one-third the total of body-length; rostrum short, only reaching as far forward as the second peduncular article of the inner antennae, acute-tipped, slightly crested, with eleven acute forward-directed teeth on the upper margin besides the apical tooth; four of these teeth are postorbital on the carapace, a row of cilia anterior to each tooth; the rostrum extends back on the carapace for two-fifths of the length of the carapace; the under margin of the rostrum has three teeth in addition to the apical tooth; there is an approximately median longitudinal carina on each side of the rostrum which is continuous posteriorly on the margin bounding the ocular cavity. The antennal spine is short, acute, the lateral margin carinate and bent under the body. The abdominal segments, including the telson, uropoda and pleopoda, are practically identical in shape and proportion to those of *M. olfersi.*

Macrobrachium jamaicense (Herbst), natural size.

The eye is large, spherical, set on a short articulated stalk.

The inner antennae have the basal article concave beneath the eye for the reception of the cornea, and terminating anteriorly at the outer distal angle in a pointed tooth; the second article is stocky, cylindrical, with the upper margin convex, cilated; the outer distal angle produced into a long, triangulate tooth, closely applied against the next segment and ciliated outwardly; the inner lower, distal angle is produced into the longest spine of the series, it extending the entire length of the third article and being ciliated beneath; the third article is also cylindrical, about as long as the second, and supports the three-whip flagellum; the inner branch of which is single, slender; the outer branch is biramose after about the tenth annulation, the inner whip is the shorter and the outer, the heaviest of the series.

The external antennae have the basal article short, a conical tooth at its outer distal angle; the scaphocerite is long, extending beyond the peduncle of the inner antennae for a distance equal to the length of the third article; the outer margin of the scaphocerite is straight, thickened, and terminates subdistally in an acute tooth, a suture line extends obliquely in beside this tooth to about midway the scaphocerite; a groove extends subparallel and near to the outer margin; the distal margin is rounded and so is the inner lateral margin, both are ciliate; the second and third peduncular articles are short, stocky, lying beneath the scaphocerite and extending only half its length; the flagellum is thick proximally, but very attenuated distally, and is as long as the body of the animal.

The external maxillipeds are slender, leg-like, bristling with setae.

The first legs are extremely slender and weak, chelate, about as long as the smaller leg of the second pair in young specimens, but shorter in older ones.

The second legs are decidedly unequal, the right being the larger. One specimen in the American Museum from Panama has the second legs about equal. The ischium is elongated, the merus a third longer than the ischium; the carpus five-sixths as long as the merus; the propodus, including the finger, three times as long as the merus, the palm being cylindrical, slightly compressed laterally, the fingers about as long as the palm, slender, cylindrical, each with one or two large triangulate teeth, the tips curved upon each other. The distal part of the merus and the entire carpus and propodus, including the fingers, are covered with numerous fine rugosities set with setae.

The third, fourth and fifth pairs of legs are similar, subequal, fairly stout and with the dactyl short, acuminate.

SYNONYMY.—*Cancer (Astacus) jamaicensis* HERBST, Naturg. Krabben u. Krebse, vol. 2, p. 57, pl. 27, fig. 2, 1792.

Palaemon jamaicensis H. MILNE EDWARDS, Hist. Nat. Crust. II, p. 398, 1837.—ORTMANN, Zoöl. Jahrb., vol. 5, p. 729, pl. 47, fig. 7, 1891.—MOREIRA, Archiv. Mus. Nac. Rio de Janeiro, vol. II, pp. 13, 78, 1901.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 112, 1927.

Bithynis jamaicensis POCOCK, Ann. Mag. Nat. Hist. (6), vol. 3, p. 10, 1889.—RATHBUN, Bul. U. S. Fish. Comm., vol. 20, part 2, p. 123, 1900 (1901).

Macrobrachium jamaicense RATHBUN, Proc. U. S. Nat. Mus., vol. 38, p. 561, pl. 51, fig. 1, 1910.—SCHMITT, Zoölogica, N. Y. Zoöl. Soc., vol. 5, No. 15, p. 169, 1924; Bull. Amer. Mus. Nat. Hist., vol. 53, pp. 37-39, 1926. (Discusses the separation of the African species long confused with *M. jamaicense* by various authors.)

Family: PONTONIDAE.

Genus: PONTONIA Latreille.

Pontonia margarita S. I. Smith.

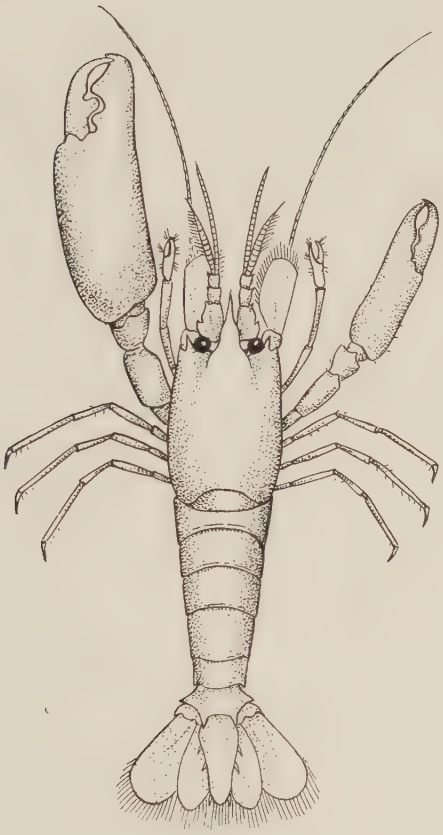
Plate 52.

TYPE: From the Bay of Panama, in pearl oysters; depository not cited.

DISTRIBUTION: Costa Rica to Panama, in *Margaritiphora fimbriata* and *Pinna* sp.

MATERIAL EXAMINED: Two specimens taken at Punta Arenas, Costa Rica, February, 1928, by the *"Ara."*

TECHNICAL DESCRIPTION: Carapace is 15 mm. long, including the rostrum, which is 3.6 mm. from tip to orbital angle, a slender acuminate triangle, with the dorsal surface flat, glabrous. The rostrum extends as far forward as the distal end of the second peduncular articles of the antennulae. The carapace is four-fifths as wide as long, glabrous, with a slender, acute, branchiostegal spine which is about as long as the basal antennal article. The abdominal segments in the female are broad, with well-developed, rounded epimeral plates, except the sixth segment, which is produced into a narrow, triangulate projection, one on each side at the base of the telson, which is about one and one-half times as long as the sixth segment, narrow, tapered, the



Pontonia margarita S. I. Smith.

apex truncated and armed distally with four pairs of articulated spines, the outer pair of which are the thicker; there are two pairs of articulated, short, blunt spines, the proximal pair placed midway the length of and near the lateral margin, the second pair about halfway between that and the distal margin. The caudal fan has both blades of the uropoda longer and wider than the telson, the inner blade being a very little longer and about one-fourth narrower than the outer blade; both are broadly oval, with only a brief fringe of cilia distally.

The antennulae have the first article elongate and flattened, slightly concave dorsally, with a leaf-like process on the outer lateral margin and not quite as long as the rostrum; the second article is short, cylindrical, nearly as wide as long, reaching to or half a millimeter beyond the rostral tip; the third article is subequal to the second article; the flagellum is biramose, the thicker branch consisting of about ten stocky rings, which are heavily setose on the lower surface. The slender branch consists of twelve to fifteen rings and is not much longer than the thicker branch.

The antennae have a short peduncular article; the scaphocerite is oval, exceeding the length of the peduncular article by about the length of the third article, and its median width is equal to half its length, the distal margin evenly rounded and only slightly ciliated. The carpocerite is very slender and cylindrical, extending only two-thirds the length of the scaphocerite and being of only slighter greater diameter than the flagellum, which is tapering, two and one-half times as long as the scaphocerite.

The eyestalk is stocky, cylindrical, two-thirds as long as the rostrum, beneath which it lies, the cornea small, terminal, of slightly less diameter than the stalk.

The first legs are very slender, chelate, the merus elongated, flattened; the carpus slightly longer than the merus, cylindrical, but much narrower basally than distally; the propodus, including the dactyl, is only three-fourths as long as the carpus, the palm is cylindrical, of about the same diameter as the distal half of the carpus; the fingers are about as long as the palm, the cutting edges meeting. The entire length of both fingers are set with bristly clusters of setae.

The second legs are markedly unequal, the left claw being much the larger; both claws lying in the bent position characteristic of members of the genus. The female has the merus short, less than one-third the length of the palm, as wide as long, with the lower distal margin

obliquely excavate for the articulation with the carpus, which is short, bulbous, encupping the base of the propodus; the latter in the larger chela is 17 mm. long, of which the lower finger is 5 mm.; the palm is moderately swollen, the hinder end slightly dilated posteriorly; both lateral faces of the palm moderate, convex; the lower finger is the larger, armed with two coarse teeth fitting between the one coarse tooth of the slenderer, curved, hinged finger fits; the apex of the lower finger is much down-curved.

The smaller second chela is of similar contour to the larger one, but the hinged finger has one tooth and the lower finger none.

The three pairs of ambulatories are slender, each with the propodus twice the length of the carpus; the dactyl very rudimentary, with a small curved apex.

SYNONYMY.—*Pontonia margarita* SMITH, as footnote in A. E. VERRILL, on "Parasitic Habits of Crustacea," American Naturalist, vol. 3, p. 247, 1870.

Family: **HIPPOLYTIDAE.**

Genus: **HIPPOLYTE** Leach.

Hippolyte projecta (Spence Bate).

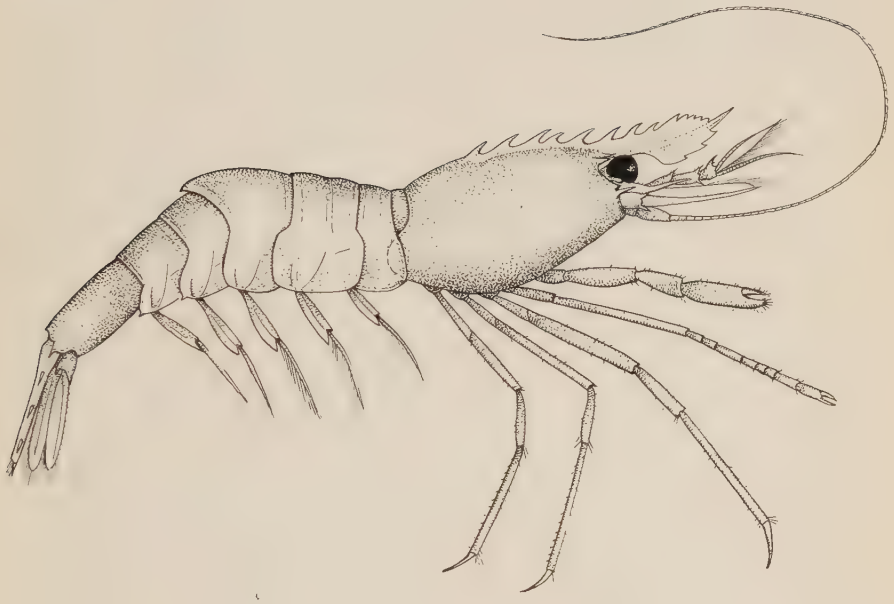
Plate 53.

TYPE: A single specimen taken by the *"Challenger"* off Nova Scotia and deposited in the British Museum.

DISTRIBUTION: Hitherto known only from the type locality. Range extended to seven miles off Port Basque, Newfoundland, depth 200 fathoms, by the *"Ara"* specimen.

MATERIAL EXAMINED: One specimen dredged in 200 fathoms, 7 miles S. W. by W. of Port Basque, Newfoundland, September 1, 1926, by the *"Ara."*

TECHNICAL DESCRIPTION: Animal about 30 mm. long, the abdomen angulated at the third and fourth segments. Rostrum two-thirds as long as the carapace, apex directed upward and very acuminate; lower margin laminate, convex beyond the eye and armed with three coarse, serrate teeth; upper margin crested and armed with five small teeth anteriorly, which are relatively close-set, and behind which there are two coarse and more widely separated teeth, the hinder of which is above the orbit. The rostral carina is continued on the carapace to within a short distance of the posterior margin, the carina bifurcating behind the last tooth; there are six coarse teeth on the carapace, besides the above-mentioned two large teeth on the hinder part of the



Hippolyte projecta (Spence Bate), about ×3.

rostrum, making a total of eight large and five small teeth on the median carina and rostrum in addition to the apical spine. The carapace is glabrous, with a small, acute, preorbital spine and immediately behind this a longer, sharper preorbital spine. There is a less conspicuous suborbital spine and a very prominent antennal spine. The abdomen has the third segment produced in the median posterior region, rounded, the remaining segments bent downward. The epimeral plates of the first four segments are rounded, the fourth epimera also having a slight tooth toward the posterior lateral region. The fifth epimera are less evenly convex, with a more prominent tooth at the postlateral angle. The sixth segment is longer than the fifth and has a pair of submedian triangulate processes, one on each side of the base of the telson; the lower postlateral angle has a small spine. The telson is as long as the caudal fan, with the distal margin bluntly rounded and three pairs of submedian, articulated spines in longitudinal series on the dorsal surface. Both blades of the caudal fan are rounded distally and ciliated, the outer blade the broader, with a sharp incision at the subdistal tooth on the outer margin.

The eye is prominent, hemispherical, with an ocellus.

The antennulae have the basal article concave, elongated, with an attenuated, acuminate, acicular-like process on the outer lateral border, its apex extending slightly beyond the segment; the second segment is short, with a spine at its outer distal margin; the third article is shorter than the second, with a very sharp spine at its upper distal angle; the flagella are short, the inner one slenderer and a little longer than the short, thick outer branch which has a heavy brush of setae.

The basal antennal article has two spines on the outer lateral margin, the second and third articles are slender, cylindrical and extend about to midway the scaphocerite. The scaphocerite is as long as the rostrum, with a tooth at the outer distal angle, the distal margin convex and ciliated.

The external maxillipeds are robust, long, extending slightly farther forward than the scaphocerite and armed on the distal margin with five or six strong, horny spines.

The first legs are robust, when extended, reaching as far forward as the tip of the scaphocerite; the merus, carpus and propodus are swollen, convex, the fingers stocky, two-fifths as long as the palm, with the tips horny, acute, the upper finger closing between the apices of the bifid lower finger.

The second legs are very slender, very long, when extended, reach-

ing beyond the tips of the maxillipeds; the ischium and merus are practically subequal, elongate, the distal end of the merus reaching to the base of the second peduncular article of the antennae; the carpus consists of ten elongate articles and extends to the tip of the maxilliped; the propodus is weak, about twice as long as the distal carpal article, the palm being one-half of this length, the fingers tapering, horn-tipped.

The third legs are as long as the second, slender, monodactyl, with an acuminate, rather short, slightly curved dactyl; the inferior lateral margin of the propodus is set with a series of spine-like stiff setae. The fourth and fifth legs are like the second but are successively shorter.

SYNONYMY.—*Hippolyte projecta* SPENCE BATE, *"Challenger"* Macrura, XXIV, p. 2, p. 594, 1888, pl. CV, fig. 3, a-b.—WHITEAVES, Catal. Marine Invert. Eastern Canada, publ. by Geol. Survey Canada, 1901, p. 250.

Genus: **TOZEUMA** Stimpson.

Tozeuma carolinense Kingsley.

Plate 54.

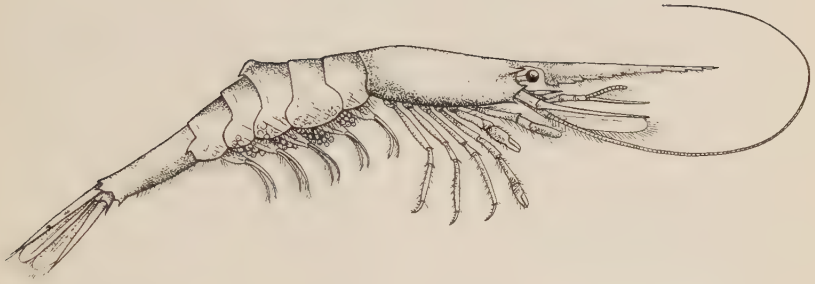
TYPE: Collected at Beaufort, N. C., by Prof. A. S. Packard.

DISTRIBUTION: Fort Macon and Beaufort, N. C., to Florida, along the coast of the Gulf States to Texas, in the Bermudas, in the West Indies, at Porto Rico, and St. Thomas, D. W. I., and Curaçao.

COLOR: Mr. Vanderbilt's field-sketch and notes show the entire animal to be a vivid green, about the same color as the sea-grass, *Zostera,* in which the animal lives.

MATERIAL EXAMINED: Seven specimens, two of which are large females, each carrying about 300 to 400 oval eggs, from Double-Headed Shot Cay, Cay Sal Bank, Bahamas, February 19, 1925, 5½ fms.; grassy bottom. In the more developed groups of eggs, the eye-spots and dorsal keel-spine are visible.

TECHNICAL DESCRIPTION: Animal very attenuated, "humped" or bent downward from the third segment posteriorly. Rostrum dagger-like, a couple of millimeters longer than the carapace, directed straight forward, tapering to a very acuminate point distally; the dorsal surface is moderately convex and thickened; the ventral surface is produced into a thin laminate keel, which extends from the apex to just anterior of the cornea where it is widest; the entire lower margin is serrulate, with 10 to 18 sharp little teeth between which are fine cilia.



Tozeuma carolinense Stimpson, ×2.25.

The carapace is moderately compressed, smooth, with a strong, acute preorbital spine; the postorbital angle bluntly triangular, the pterygostomian spine acute. The first and second abdominal segments are of about equal length in the median line; the first segment has the epimeral region curved forward, anteriorly overlapping the posterior margin of the carapace; the second segment has the epimera broadly rounded, subcircular, overlapping both adjacent segments. The third segment is longer in the median line than the second, being produced into a decided hump posteriorly; the epimeral plates of this segment are rounded, like those of the second segment but not so large. The body is sharply angulated at the union of the third and fourth segments. The fourth segment is two-thirds as long in the median line as the third and has its epimera posteriorly produced and convex, overlapping the fifth segment, which is very similar to the preceding segment but a fourth longer and with a small tooth at the upper posterior angle of the epimera; the sixth segment is very long and attenuated, about two and one-half times as long as the fifth segment, with a triangulate tooth on each side projecting upon the side of the telson and a smaller, acute spine at the posterior angle of the lateral margin. The telson is almost as long as the sixth segment, tapering, triangulate, armed with two pairs of articulated spines; the caudal fan has a short, simple peduncle with a spine at the outer distal angle; the inner blade is long and slender, with the lateral margins subparallel, the distal margin convex; the outer blade is similar but wider and with more of the distal margin convex. Both are finely ciliated on the margins.

The eye is on a stocky, cylindrical stalk, a spherical cornea, deep brown. When retracted, the eye lies in a cavity beneath the rostrum and above the excavate peduncular of the antennulae.

This basal article of the antennulae is much elongated and bears on its outer side a long slender acuminate spine, which reaches as far as the article; the second and third articles are successively shorter; the shorter, thicker branch consists of about ten rings and bears a dense brush of setae on the lower margin; the longer branch consists of about 18 to 20 rings and has only a single setum per annulation. The antennulae lie beneath the rostum on either side of its laminate ventral keel.

The antennae have a rather elongated, cylindrical basal joint, with a spine at its lower, outer distal angle; the scaphocerite is three-fourths as long as the rostrum, narrow, tapered, the outer lateral margin straight, a tiny spine at the distal angle; the distal margin convex,

the inner lateral margin slightly so, both ciliated. The second and third peduncular articles are slender, elongate, cylindrical, the whip slender, two and one-third times as long as the rostrum.

The first legs are short, stocky, chelate.

The second legs are longer, slenderer, with the carpus more elongate than in the first legs.

The third, fourth and fifth legs are monodactyl, slender, each with the propodus elongate, the dactyl scarcely half so long, curved, acuminate, both joints armed along the inferior lateral margin, with a row of spinules, also setae.

SYNONYMY.—*Tozeuma carolinensis* KINGSLEY, Proc. Acad. Nat. Sci. Phila., vol. 30, p. 328, 1878; *op cit.*, vol. 31, p. 413, pl. 14, fig. 8, 1879 (1880); Amer. Nat., vol. 33, p. 715, fig. 8, 1899.—VERRILL, A. E., Trans. Conn. Acad. Arts and Sci., vol. 11, p. 19, 1901.—M. J. RATHBUN, *Tozeuma carolinense* M. J. RATHBUN, Bull. 20, U. S. Bur. Fish., vol. 20, pt. 2, p. 114, 1901.—HAY and SHORE, Bull. U. S. Bur. Fish., vol. 35, p. 391, pl. 27, fig. 2, 1918.—VERRILL, A. E., Trans. Conn. Acad. Arts and Sci., vol. 26, p. 127, pl. 19, figs. 3-3m, pl. 42, figs. 11, 1f, text fig. 10, 1922.

Genus: **SPIRONTOCARIS** Spence Bate.

Spirontocaris tenuis (Spence Bate).

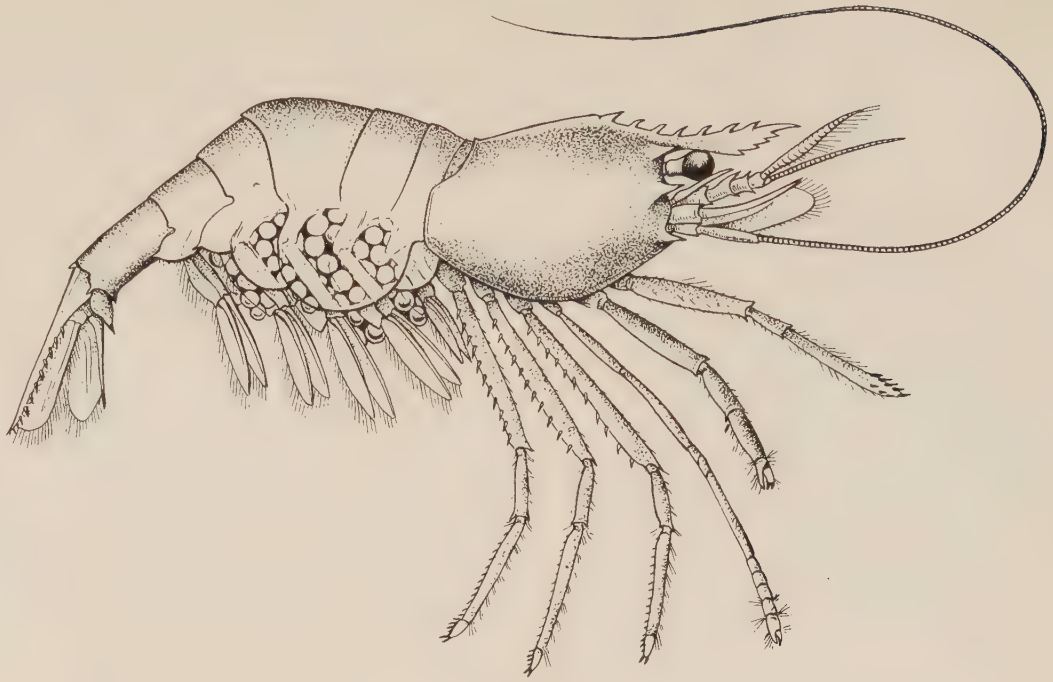
Plate 55.

TYPE: The type was taken by the "*Challenger*" off Nova Scotia, in 85 fms., and is deposited in the British Museum.

DISTRIBUTION: Hitherto known only from the type.

MATERIAL EXAMINED: Five specimens, one of which is very small, the other four are large, ovigerous females taken in dredge in 200 fms. of water, September, 1926, nine miles southwest by west of Port Basque, Newfoundland, by the "*Ara*," William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Female: Body robust, rostrum laminate, abdomen beyond the third segment bent downward. Rostrum 89 mm. long, carapace 13 mm. long; abdomen about two and two-thirds times as long as the carapace. The rostrum is directed forward in almost a straight line for the proximal three-fourths, the distal fourth being curved upward slightly, but the entire rostrum is less elevated than the crested anterior portion of the carapace with which it is continuous. There are seven acute, forward and upward directed teeth, three on the carapace and four on the upper rostral margin; in addition to



Spirontocaris tenuis (S. Bate), ×2.

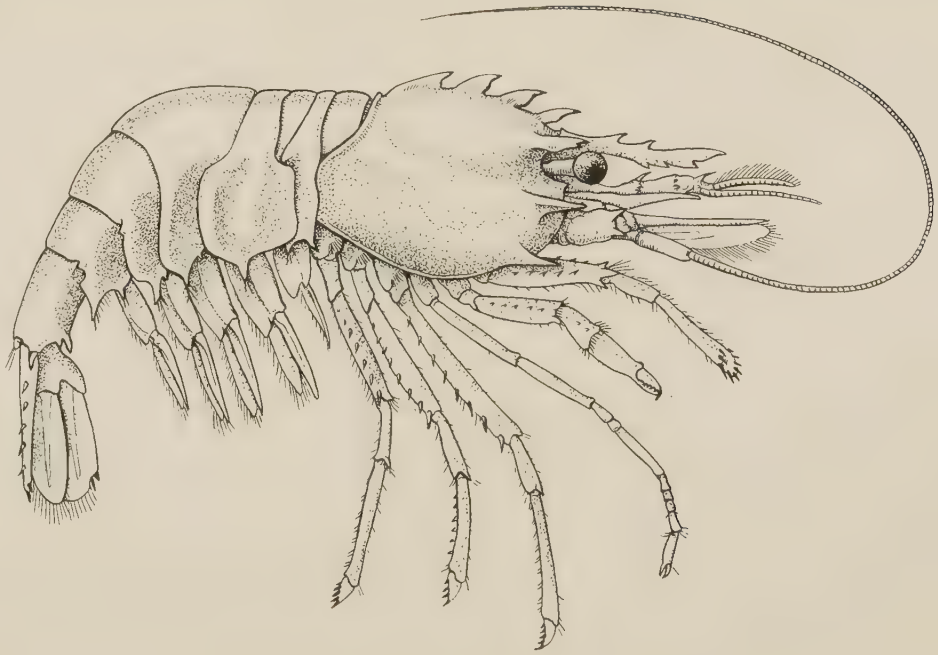
the apex, which itself is a large triangulate tooth; the under portion of the carapace produced into a thin laminate blade with the lower margin very convex from the apex to above the cornea, armed with four acute, forward-directed spines, the distal of which is the largest and is placed much nearer the apex than is the most distal spine of the upper margin; the second spine of the lower margin is opposite the first spine of the upper margin; the third spine is smaller and set closer to the second, while the fourth spine is as small as the third and set close to its base, about opposite the base of the first spine of the upper margin. The rostrum is very narrowed above the eye. There is a slightly longitudinal carina on each lateral face of the rostrum, which is continuous posteriorly with the ocular margin. The preorbital spine is conical, acute, directed forward and upward. The postorbital angle is right-angled, slightly rounded. The branchiostegal spine is subequal to the antennal spine; the pterygostomian spine is shorter, but acute and well developed. The crested carina of the median line of the carapace is continued posteriorly for three-fourths of the length of the carapace, but its three spines are placed anteriorly. Carapace smooth, pliable.

The abdomen has the first segment 2.5 mm. long in the median line with the lateral margin slightly wider, rounded and overlapped on the posterior side by the large projection of the second segment; the second segment is 3.5 mm. long in the median line and has the lateral part expanded into a subcircular plate which is ciliate on the margin and overlaps both adjacent segments; the third segment is greatly produced in the median line, being 9 mm. long; the margin is produced to a rounded point in the median line and concave on either side, the lateral part being much narrower, with the lateral margin rounded, ciliated; the fourth segment is narrower, 4 mm. long in the median line, with the posterior margin straight in the median region, notched in the upper lateral region and thence directed obliquely outward to the acute point of the lateral plate, which has its outer margin more convex than the inner; the fifth segment is narrower than the fourth and about one millimeter longer in the median line, with the posterior margin similar to that of the fourth segment, except that the postlateral angle is more produced, the acuminate tip larger and the inner lateral margin concave; the sixth segment is very narrow, one and seven-eighths times as long as the fifth segment, a produced triangulate process on each side projecting above the outer basal angle of the telson; the posterior margin above the base of the uropod is

concave and the outer distal angle is an acute small spine. The telson is as long as the uropoda, or one and one-fourth times as long as the sixth segment, narrowed distally, the distal margin truncated, only very slightly rounded, and armed with about eight sharp, articulated spines; the upper surface of the telson is flat and the narrow lateral portion is bent down almost at right angles to the upper; a row of about nine articulated spines on each side marks the margin of the upper surface of the telson. The uropoda have the peduncle produced to an acuminate process at the outer distal angle; the blades are each subequal, narrow, tapered distally to a narrowed apex and with the entire margins ciliated. There are three pairs of teeth on the three posterior segments of the body. The manner of carrying the eggs is well illustrated in the accompanying figure. Each of the four females taken carries from 90 to 100 large spherical eggs.

The eyes are very short-stalked, there being also a small rounded ocellus on the upper surface of the stalk; the cornea is spherical, of greater diameter than the stalk, shining black, composed of numerous small facets.

The inner antennae have the basal peduncular joint longer than and excavate beneath the eye, with a short acuminate spine at its distal angle, and a long, acuminate, tongue-like spine resembling an acicule at its outer lateral angle, with the incision separating it from the main part of the article reaching almost to the base, while the apex of this spine reaches almost to the distal margin of the second article; the second peduncular article is short, subcylindrical, with an acute tooth at its upper, outer distal angle and a few cilia along the distal margin; the third article is scarcely two-thirds as long as the second and bears an acute spine at its upper distal margin; the inner whip of the flagellum is much the slenderer and consists of 46 to 50 short rings, each with a single, up-pointing seta at the distal margin; the outer whip is much thickened for the proximal two-thirds of its length and bears on the upper surface of this part a long, thick brush of fine setae; the distal third is a fine whip; the entire whip consists of about forty rings. The external antennae have the proximal article stout, with an acuminate triangulate spine at the outer distal angle; the scaphocerite is longer than the rostrum and has the outer lateral margin thickened, terminating subdistally in an acute spine; the distal margin is evenly rounded and ciliate. The second and third peduncular articles are short, cylindrical; the flagellum is very long and slender, being multiarticulate, 54 mm. long.



Spirontocaris groenlandica (Fabricius), × 1.5.

The external maxillipeds are stout, leg-like, the distal article long, cylindrical, very setose at the distal end and somewhat flattened and bearing nine unequal black spines on the margin.

The first legs are chelate, shorter than the maxillipeds; the merus cylindrical, elongated; the carpus similar but only two-fifths as long; the propodus about as long as the merus, cylindrical and somewhat swollen; the fingers subequal; the lower with a curved black tip which fits between the similar bifid tip of the upper finger.

The second legs are very slender, nearly one-third longer than the first pair, with the multiarticulate carpus consisting of seven joints; the propodus weak, about as long as the distal carpal joint and the fingers comprising only two-fifths of its length, set in tufts of fine setae.

The third, fourth and fifth pairs of legs are similar and subequal, each has the merus very slender, elongated, armed on the lower outer lateral margin with a row of nine or ten acute, articulated spines; the carpus is slender, three-fifths as long as the merus, with a short round process projecting from the upper distal margin; the propodus is as long or a trifle longer than the merus, compressed, cylindrical, armed on the lower margin with a series of spine-like setae; the dactyl is short, being only one-fifth as long as the propodus, with the tip a sharp, curved, brown spine and with a similar subdistal spine causing the dactyl to appear bifid; also four articulated spines along the inferior lateral margin.

SYNONYMY.—*Hetairus tenuis* SPENCE BATE, Voy. *"Challenger"* Rept. Macrura, vol. 21, pt. I, p. 613, pt. 2, pl. 99, fig. 3, 1886.—WHITEAVES, Catal. Marine Invert. Eastern Canada, pub. by Geol. Survey of Canada, 1901, p. 252.

Spirontocaris groenlandica (Fabricius).

Plate 56.

NAME: The name was adopted from the type locality.

TYPE: The type is from the "seas of Greenland."

DISTRIBUTION: This species is abundant in the laminarian zone of the western Atlantic from Salem, Mass., northward to Hudson Strait, Greenland and Grinnell Land.

MATERIAL EXAMINED: Five specimens (four of which are ovigerous) dredged in seven fathoms, mud bottom, upper end of Whitehaven Harbor, Nova Scotia, September 1, 1926.

Technical description: Female: Rostrum six mm. long, carapace 12.5 mm. long, abdomen 31 mm. long. Rostrum blade-like, directed forward at an acute angle, the apex a broad, acute triangulate tooth; the inferior margin armed on its distal half with two small, acute, triangulate teeth; the upper rostral margin is armed with two teeth; the anterior of which is placed about one-third the distance from the apex, while the second spine is one-third of the distance from the base. There is a crested carina behind the rostrum, extending the length of the carapace and ornamented with four, acute, triangulate, forward- and upward-directed spines, spaced subequally on the anterior four-fifths of the carapace. The spines decrease slightly in size from front to rear of the series, but the smallest one is substantially larger than the rostral spines.

The preorbital spine is forward-directed, very acute, about half as long as the eyestalk; the suborbital angle is triangular and not spinous; the antennal spine is also acute, forward and slightly outwardly directed; there is no branchiostegal spine, but the pterygostomian spine is subequal to the antennal spine but is directed straight forward. The lateral margin of the carapace is convex and is emphasized by a flat carina. The posterior margin also has this carina. The posterior margin is concave in the median area and convex on either side. There is a slight longitudinal depression on either side anteriorly below the antennal spine. The entire surface is marked by fine punctae from which fine, slender, upstanding hairs arise.

The first abdominal segment is not quite as long in the median line as the second and has its lateral part no wider than the median, but rounded, and with two spines separated by a shallow concavity on the distal, lateral margin and with a depression on the outer face. The second segment is widened laterally into a subcircular plate that overlaps the first and third segments and has at its apex a single spine; two depressions on its outer face. The third segment is much lengthened in the median region, being twice as long as the second segment, with the posterior margin convex in the median line, then slightly concave and again convex on the lateral margin, which is about as narrow as that of the first segment and is produced to an acute median spine on the lateral margin; the fourth segment is only one-third as long as the preceding segment in the median line and has its median posterior margin nearly straight at each end, with a small, rounded tooth separated on each side by a shallow sinus, beyond which the lateral portion is very convex on the posterior side and moderately so on the

anterior, being produced to an acute tooth which is directed slightly posteriorly on the outer surface; there is a median depression; the fifth segment is nearly one and one-half times as long as the fourth and has its posterior margin similar across the median region and including the small, rounded tooth on the upper lateral region; the lateral part is different, the posterior lateral margin being scarcely at all convex, while the anterior lateral region is very convex and bears a small, acute, posteriorly directed tooth on the median part and a large, triangulate, acute tooth at the apex which is directed posteriorly; the sixth segment is narrower than and one and one-half times as long as the fifth, transversely convex, with the lateral margin not produced; an acute, outward and posteriorly directed tooth at the outer basal margin of the uropod, above which the margin of the segment is excavate and produced into an acute, triangulate tooth which projects above the telson near the outer basal margin; the median posterior margin of the segment is relatively straight, with the little, rounded tooth on either side. The telson is twice as long as the fifth segment and narrow, tapering slightly to a triangular apex, the dorsal surface flattened with a longitudinal depression and defined from the narrow lateral part by a row of seven articulated spines on each side set subequally; there are two similar articulated spines on the terminal margin on each side of the apex. The uropoda are as long as the telson and consist of a short, flat peduncle, which is produced at its outer angle into a broad, triangular process with a spine at the apex, and a shorter, triangular inner lobe, the two being separated by a V-like incision. The blades are both oval, the inner one narrower and with a median, longitudinal ridge on the proximal part; the outer blade has a similar keel, the distal third of the blade partly separated from the proximal by a suture, and there is an acute spine on the outer lateral margin of the proximal section at this suture; the inner lateral margin is more convex than the outer. Both blades are fringed distally with close-set, plumose setae.

The eyes are small, cylindrical, the cornea terminal, shining black.

The antennulae have the proximal article longer than the eyes, concave beneath the eye, with the outer margin terminating in a slender acute spine which has its base midway the joint and its apex reaching to the base of the third joint; there is a short, up-pointing spine on the distal margin of the first article; the second article is short, cylindrical, with an acute spine on its upper distal margin; the third article is very short and has an acute spine at its distal margin; the flagellum

is two branched, the longer, slenderer branch composed of thirty-two articles and extending beyond the scaphocerite a short distance; the thickened branch consists of 22 to 24 short articles and bears a dense brush of setae on its upper surface.

The antennae have the basal article slightly longer than the eye and produced on its outer lower and upper margin each into an acute spine; the scaphocerite has the outer margin thickened and terminating distally in an acute spine that extends quite as far forward as the distal margin of the rounded inner part of the scaphocerite, which is ciliated; the second and third pedunculate articles, which are cylindrical, lie beneath the scaphocerite, extending half its length; the flagellum is very slender, multiarticulate, about as long as the body of the shrimp.

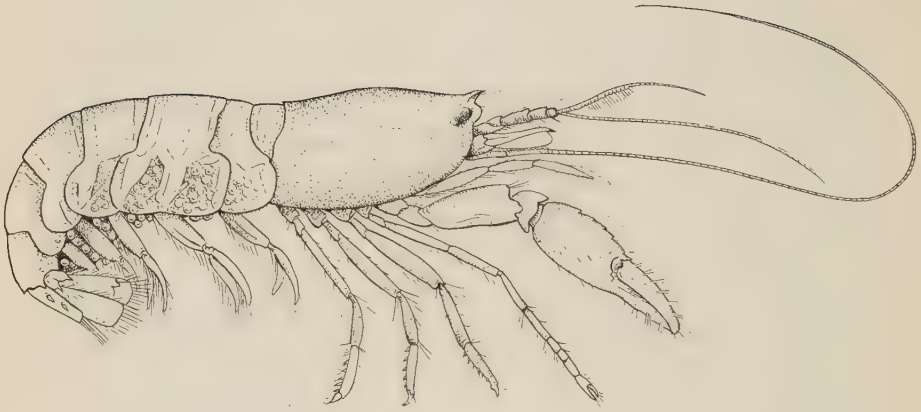
The external maxillipeds are heavy, long, leg-like, exceeding in length the first pair of legs; the distal joint is rather flattened dorsoventrally and very setiferous, armed on the distal margin with 8 to 10 black acute spines; the preceding article has two spines at its distal margin.

The first legs are chelate, rather short and stocky, with the carpus half as long as the propodus, the palm is convex, moderately swollen, the fingers not quite as long as the palm, convex, the upper finger curved, bifid at the tip, horny; the lower finger with an acute, upcurved tip fitting between the tips of the upper finger.

The second legs are extremely slender, slightly longer than the first pair, the ischium elongated, subequal to the merus, the carpus composed of seven subequal joints; the propodus small, the palm scarcely longer than the last article of the carpus; the fingers slender, acute tipped, with several small, accessory spines near the tip.

The third, fourth and fifth legs are subequal, stronger than the first pair, long, slender, the merus elongated; the carpus is one-third as long as the merus, with a rounded process on the anterior distal margin; the propodus is about as long as the ischium and merus considered together; subcylindrical, compressed laterally, armed on the inferior lateral margin with a continuous double row of acute brown spines; the dactyl is only one-fourth as long as the propodus and armed with three acute brown spines on its inferior lateral margin and two much larger, curved spines at the apex, giving it a decidedly bifid appearance.

The pleopoda are very stout; their mode of protecting the eggs is well illustrated in the accompanying figure.



Alpheus bouvieri chilensis Coutière, × 2.

SYNONYMY.—*Astacus groenlandicus* J. C. FABRICIUS, Syst. Entom., p. 416, 1775; Entom. Syst. auct. et emend., vol. 2, p. 484, 1793.

Cancer aculeatus O. FABRICIUS, Fauna Greenlandica, p. 239, 1780.

Alpheus aculeatus SABINE, in Suppl. to Appendix of Parry's (first) Voyage, p. 237, pl. 2, figs. 9 and 10, 1824.

Hippolyte aculeata J. C. ROSS, in John Ross, Appendix to Narrative of a Second Voyage in Search of a Northwest Passage, II, p. 83, 1835.—GOULD, A. A., Report of Invert. of Mass. Crust., p. 332, 1841, Cambridge, Mass.

Hippolyte armata OWEN, Zoölogy, in Capt. F. W. Beechey's Narrative of a Voyage to the Pacific and Bering's Strait, to coöperate with the Polar Expedition, performed in H. M. S. Blossom, Crust., p. 88, pl. 27, fig. 2, 1839 (female).

Hippolyte groenlandica MIERS, Ann. Mag. Nat. Hist. (4), vol. 20, p. 62 (12), 1877.—S. I. SMITH, Trans. Conn. Acad. Arts and Sci., vol. 5, p. 85, pl. 10, fig. 2, 1879.

Spirontocaris groenlandica WALKER, Trans. Liverpool Biol. Soc., vol. 7, p. 236, 1900.—WHITEAVES, Catalog Marine Invert. of Eastern Canada, in Geol. Surv. of Canada, 1901, No. 772, p. 250.—STEBBING, T. R. R., Arctic Crust. Bruce Coll. Ann. Nat. Hist., ser. 70, vol. 5, p. 527-536, pl. 21, 1900.—HOLMES, Occas. Papers of Calif. Acad. Sci., vol. 7, p. 236, 1900.—RATHBUN, M. J., Harriman Alaska Exped., Crust., vol. 10, p. 61, 1904.—RATHBUN, Rept. Canadian Arctic Exped., 1913-18, vol. 7, Crustacea, part A, Decapod Crustacea, p. 3A, 1919.

Family: ALPHEIDAE.

Genus: ALPHEUS Fabricius.

Alpeus bouvieri chilensis Coutière.

Plate 57.

TYPE: Dr. Coutière's type material came from Calbuco, Chile, and is deposited in the Paris Museum.

DISTRIBUTION: Calbuco, Chile, and Eden Island, Galapagos.

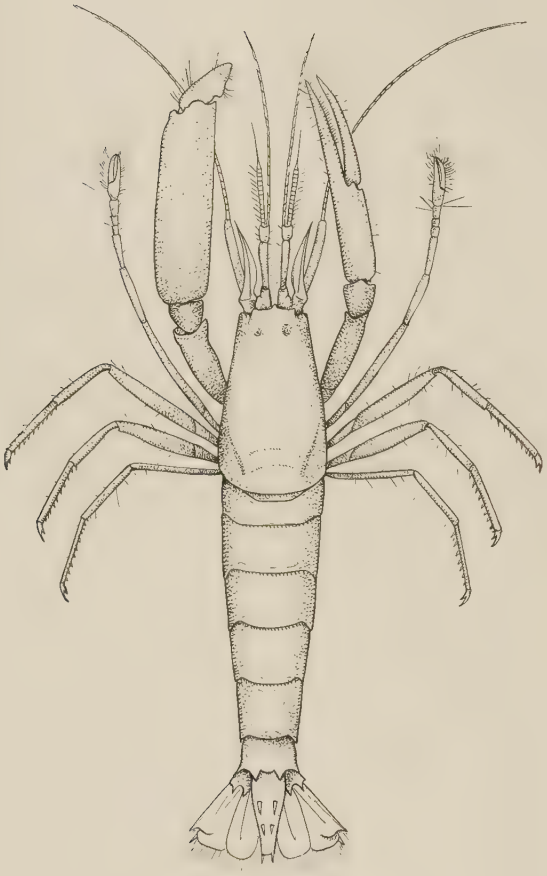
MATERIAL EXAMINED: One specimen from tide-pool, Webb Cove, Albemarle, Galapagos Islands, February 3, 1928.

TECHNICAL DESCRIPTION: Animal about 12.5 mm. long from tip of rostrum to tip of telson; carapace, including rostrum, 6 mm. long. Rostrum acute, carina-like, small, extending beyond the ocular lobe; almost to the distal end of the first peduncular segment of the antennulae. Carapace glabrous, frontal margin on each side of the

rostrum rounded over the ocular lobes and then retreating in a broad curve to unite with the lateral margin, which is sinuate, its postlateral angle being rounded and is produced on the outer posterior half of each side beyond the median posterior margin which is relatively straight. The entire animal is decidedly compressed laterally, the abdominal segments are not carinated, but show this compression pronouncedly. The first five segments are approximately subequal in length; the sixth segment is somewhat longer. The first four segments have the epimera broad and evenly rounded; the fifth segment has the epimera rounded also but produced on the posterior distal angle to an acute point, the anterior epimeral margin being rounded but much longer than the posterior margin; the sixth segment has the shape typical of members of this genus. The telson is convex on the upper surface, tapers distally and has the narrow, posterior end produced to a shallow triangle. There are two submedian pairs of spines on the telson, the anterior pair being approximately midway the length of the telson and the second pair being a little posterior to halfway the distance between the first pair and the telson. The rhipidura have a short, strong base which is produced distally to an acute point that projects over the outer blade; the lateral margins of the peduncle are finely, irregularly serrated. The inner blade is oval, nearly half as wide as long, traversed by an approximately median ridge which is set with long setae; the lateral and distal margins of the blade are fringed with setae. The outer blade is subequal to the inner but has the outer margin straight, a trifle thicker than the rest of the blade; the distal third of the blade is obliquely articulated with the proximal two-thirds, this line of segmentation being accentuated by a fringe of short setae, and at the outer margin by a spine which is the produced apex of the outer margin of the proximal portion. The rounded distal portion is heavily fringed with setae.

The antennulae consist of five peduncular articles and a biramose flagellum, the shorter, upper branch being composed of about 24 tapering articles, the median half of which bear a very prominent, curled brush of close-set setae. The longer, inferior placed flagellum consists of about 62 annulations and extends slightly beyond the distal end of the first periaepod.

The antennae have a short, stout, basal article which bears on its upper distal margin a sharp, triangular acicule that reaches to the base of the flagellum of the antennulae; the second article arises beneath the acicule and is cylindrical and about one-fourth longer than



Alpheus vanderbilti Boone, type, × 2.

the latter; the remaining articles of this pair of antennae are unfortunately broken.

The first chelipeds are rather slender; the coxa and basis are well developed, subequal; the ischium is smaller and slenderer than the basis; the merus is long, wider distally, with its outer lateral surface flat, the upper margin carinate; the carpus is scarcely one-third as long as the merus and is convex, narrow basally and about one-third wider distally; the propodus is almost as long as the carapace; half as high as long, and is moderately convex and setiferous. The propodal finger is about one-half the length of the entire propodus and is tipped at the distal end with a horny, upcurved spine; the cutting edge is rather broad, with the margins clearly defined and the median area inclined toward concavity and set with small tufts of setae subparallel to the margins. The hinged finger is subequal and similar to the propodal finger upon which it fits, the tips crossing. The entire propodus, but more densely so, the dactyli are sparsely covered with long, slender, outstanding setae.

The second legs are very long and slender; the carpal articles decrease in the following series: 1, 2, 5, 3, 4; the first article being twice the length of the second; the third and fourth articles each being one-half as long as the second, while the fifth article is one and one-half times as long as the fourth.

The third, fourth and fifth pairs of legs are similar; the merus is the longest article of each limb; the carpus is two-fifths as long as the merus and the propodus is three-fifths as long as the merus; the dactyl is short and pointed; there are four spines on the lateral margin of the propodus.

SYNONYMY.—*Alpheus bouvieri* var. *chilensis* COUTIÈRE, Lenz, Zoöl. Jahrb. Suppl., vol. 5, 1902, p. 162.—SCHMITT, Zoölogica, N. Y. Zoöl. Soc., vol. 5, p. 162, 1925.

Alpheus vanderbilti, new species.

Plate 58, text fig. 5, A, B, C.

NAME: Dedicated to the collector, Mr. William K. Vanderbilt.

TYPE: An adult female taken in dredge at 20 fms. south of Sand Key, Key West, Florida, January 29, 1924.

DISTRIBUTION: Restricted to the type locality. However, it is not improbable that the specimens listed by Coutière, Zimmer and Schmitt from the Barbados as *C. cylindricus* Kingley may be *C. vanderbilti,* as the real *cylindricus* is a true West Coast species, the type having been taken at Pearl Island, Bay of Panama, by F. H. Bradley, and

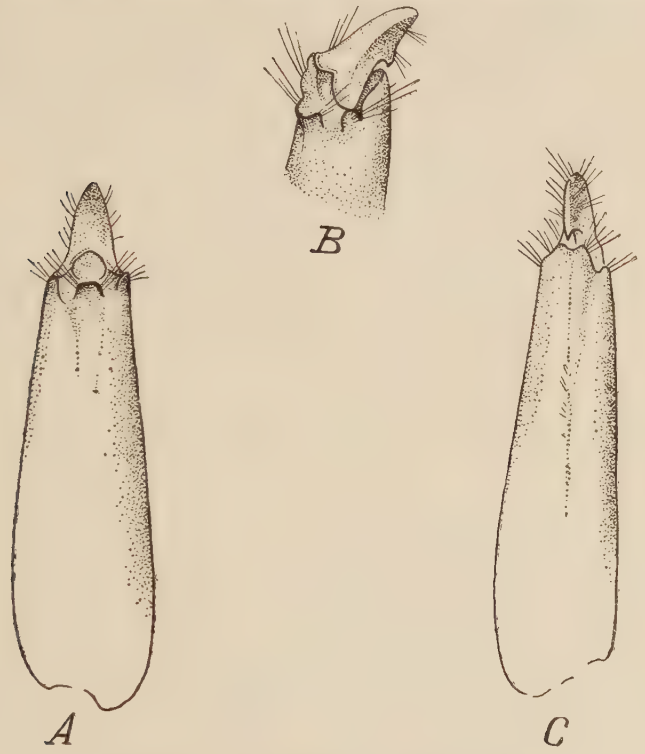
deposited in the Peabody Museum, Yale University. (See Bull. U. S. Geol. and Geograph. Surv. of the Territories, vol. IV, 1876, p. 196.)

TECHNICAL DESCRIPTION: Female: Carapace 7 mm. long, abdomen about 10 mm. long. The rostral tooth is short, acute, smooth, deflected; the orbital spines or teeth are very weak, deflected, being scarcely more than an emargination in the orbital lobe, but more clearly seen in a lateral view. Eyes small, circular, sharply defined but not projecting on the dorsal surface as convex protuberances, situated behind the frontal margin by a distance equal to, or a trifle greater than, the diameter of the cornea. The abdomen is glabrous, somewhat compressed laterally, with the epimeral plates very well developed and rounded in the female. The telson is about one and one-half times as long as the preceding segment, tapered, the distal margin being scarcely half the width of the proximal margin, rounded and ciliated. There are two pairs of submedian, articulated spines on the dorsal surface of the telson. Both blades of the caudal fan are broadly oval, the margins ciliated; the outer blade is the wider, with a subdistal spine on the outer lateral margin.

The antennulae have the basal article dorsally flattened, nearly as wide as long, constricted distally; the second article is one and one-third times longer than the first, slender, cylindrical; the third article is similar to the second but scarcely half as long and supports a biramose flagellum, the longer, slenderer, inner branch reaching to the base of the hinged finger of the great chela; the thicker branch not over half so long and with a dense brush of furry short setae on the under side.

The antennae have the basal article short, the scaphocerite as long as the peduncular articles of the antennulae and also the same length as the carpocerite of the antennae. This scaphocerite is slender, thickened, acuminate, with the outer margin curved, concave, much thickened; the inner lateral margin is convex proximally, tapered distally, the usual laminate portion of the scaphocerite is nearly obsolete. The second peduncular article of the antennae is short, the carpocerite is long, slender, cylindrical, extending as far forward as the antennular peduncle and the scaphocerite. *This ratio is distinctly different from that of the Pacific Coast analog, C. cylindricus Kingsley,* in which the scaphocerite reaches only to "the extremity of the second joint of the peduncle of the antennulae." The antennal flagellum is very fine and reaches beyond the extended great cheliped by a distance about equal to the length of the propodus of the latter.

The first legs are decidedly unequal in the female, the left being the larger. It has the merus elongate, slightly convex, laterally compressed; the carpus short, convex, distally cup-like; the propodus, including the finger, as long as the carapace, convex, moderately swollen proximally, less so distally; the propodal finger is represented by the blunted, excavated end of the propodus, into which the dactyl fits; there is a thin, convex lateral margin fitting closely upon each side of the proximal part of the dactyl. The dactyl is short, swings horizontally, fitting the concave propodal finger. The shape of the dactyl is best understood by an examination of the attached figures which



TEXT FIG. 5.—Large claw of *Alpheus vanderbilti* Boone, greatly enlarged. A. Dorsal view. B. Profile. C. Ventral view.

show its exact contour. There is only one tooth on the dactyl, whereas that of *C. cylindricus is said to have "two or three."* The smaller cheliped has the meral and carpal joints similar to those of the larger, and the propodus is as long, but it is slenderer, with the palm convex, tapering a little distally, about three-fourths as long as the fingers,

which are slender, subequal, with the tips slightly down-curved, meeting, with many setae in the hiatus.

The second legs are exceedingly slender, with the carpus multiarticulate, the first article twice the length of the second equal to the third and fourth taken together, which are subequal; the fifth article about one and three-fifths times as long as the fourth; the dactyl has the palm about as long as the preceding article but stouter, the fingers nearly twice as long as the palm, laterally compressed and set with tufts of bristling setae.

The third, fourth and fifth legs are similar, monodactyl, decreasing slightly in length in the order named. The merus of each is the longest and widest joint of the series; the carpus is slenderer, three-fifths as long as the merus and subequal in length to the propodus, which is set with a series of spines along the inferior lateral margin; the dactyl is short, curved, acuminate.

Alpheus formosus Gibbes.

Plate 59.

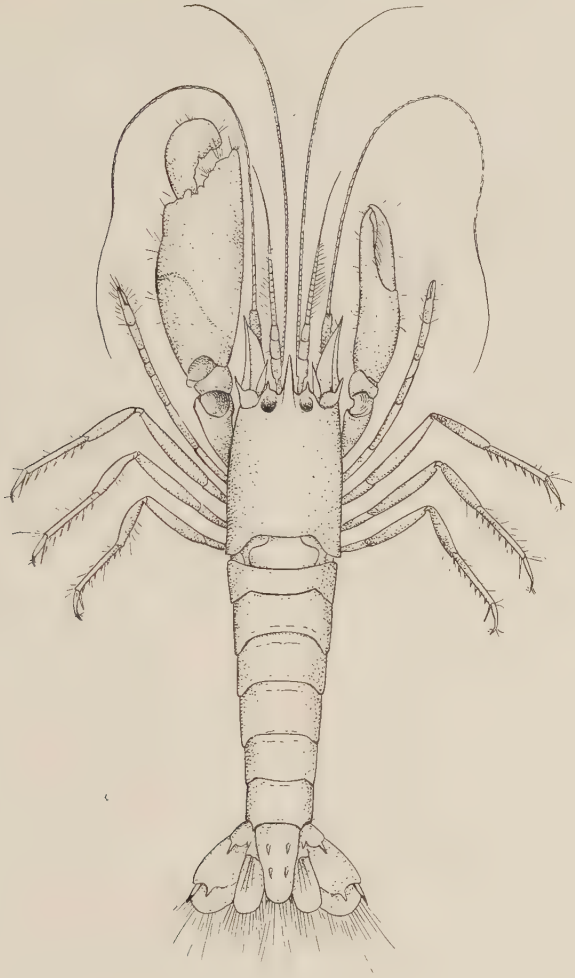
TYPE: Taken at Key West and deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: A reef-dweller, known from Key West, Florida, the Bermudas, Porto Rico, Cuba, Barbados and the coast of Brazil, as far down as Pernambuco.

MATERIAL EXAMINED: One specimen taken at Pigeon Key, Florida, February 17, 1923, by the *"Ara,"* William K. Vanderbilt, commanding.

COLOR: In life this species is one of the most vividly and characteristically colored of the sponge-dwelling shrimp. The ground-color of the body is yellowish or olivaceous green, finely speckled with bright orange, with a median dorsal and two lateral stripes of orange, pale yellow or white, and the abdominal margins vivid blue. The caudal fan is creamy proximally, margined distally with orange. The large claws are of the same yellowish or olivaceous green as the body, with the base of the lower finger white, the tips of both fingers are bright orange. The antennal and antennular flagella and ambulatory legs are vivid blue.

TECHNICAL DESCRIPTION: Animal moderately robust, with the great chela elongate-oval, swollen proximally, less so distally, devoid of notches, somewhat resembling the claw of typical *Synalpheus*. Rostrum a prominent, narrow, elongated triangle, well defined proximally, the distal three-fifths acuminate, extending beyond the frontal margin



Alpheus formosus Gibbes, × 2.

as far as the basal peduncular article of the antennulae. Orbital lobes convex, with the frontal margins rounded beyond that of the adjacent margin and armed on the superior frontal margin with an acute, small, forward-pointing spine. Carapace 10 mm. long, or seven-eighths as long as the larger chela, moderately compressed laterally. Abdomen similarly compressed, epimeral region only moderately produced and rounded marginally; telson one and one-half times as long as its proximal width, distal margin truncated, slightly rounded and heavily ciliated. Uropoda with the peduncle produced to each sharp spine at its outer distal angle; the inner blade oval, slightly longer than the telson, with a median longitudinal keel; the outer blade a little wider and longer than the inner, with the distal fourth articulated, a black, acute spine at the outer distal angle of the proximal portion of the blade and an oblique ridge on the dorsal surface directed towards this spine; the extreme distal margin rounded; both blades heavily ciliated on the distal margin.

Second peduncular joint of the antennulae about a third longer than the first joint; third article approximately one-half as long as the second; the shorter branch of the antennular flagellum about as long as the great chela, thickened for its proximal half and heavily ciliated on the inferior margin, the distal portion very fine; the longer whip about half as long as the antennal whip; the scale lanceolate, produced to an acute spine distally, reaching two-fifths the length of the second peduncular article.

The antennae have the basal article produced to a spine at its outer distal angle; the scaphocerite with the scale as long as the antennular peduncle, the lateral spine acute, projecting about a millimeter beyond the scale; the scale is wider proximally, very narrowed, tapering distally, heavily ciliated. Carpocerite cylindrical, about one millimeter longer than the antennular peduncle; flagellum slender, about as long as the body.

The left cheliped is the larger, the propodus slightly longer than the carapace; the merus is laterally compressed, somewhat dilated distally and marginally excavate for the articulation with the basally convex, cup-like carpus, which in turn is concave distally for the reception of the propodus, which is rounded and produced on the inferior proximal margin; the propodus is elongate-ovate, somewhat compressed laterally, moderately convex, with an oblique groove on the proximal half of the outer face, ending in an unequally ovate area. There is an acute spine at the inner distal angle of the palm above the base of the propodal finger, which is short, acute, with the tip in-

curved; the dactyl is a little longer, curved, beak-like, blunt-tipped. The smaller chela has the merus and carpus similar to that of the larger; the propodus is elongate, very slender, the palm with a spine on either side at the base of the hinged finger; the fingers subequal, long and slender, tapered, almost as long as the palm.

The second legs are very slim. The carpus is five-jointed; the first article three-fourths as long as the merus, the second joint one-half as long as the first; the third and fourth articles subequal, each one-third shorter than the second; the fifth article twice as long as the fourth; the palm is two-thirds as long as the fifth article; the fingers are tapered, about as long as the palm, bristly at the tip.

The ambulatories are slender, each with a series of about seven articulated spines on the inferior margin of the propodus; the dactyl short, curved, acuminate.

SYNONYMY.—*Alpheus formosus* GIBBES, Proc. American Assoc. Adv. Sci., vol. III, p. 196, 1851.—RATHBUN, Proc. Wash. Acad. Sci., vol. II, p. 152, 1900; Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 106, 1901.

Alpheus poeyi GUÉRIN, in LA SAGRA, Hist. l'ile de Cuba, pt. 2, Zoöl., vol. 7, Crust., p. 19, vol. VIII, pl. 2, figs. 10, 10a, 1857.

Alpheus websteri KINGSLEY, Proc. Acad. Nat. Sci. Phila., vol. 31, p. 416, 1879; Bull. Essex Inst., vol. 14, p. 3, pl. 2, fig. 5, 1883.—RANKIN, Ann. N. Y. Acad. Sci., vol. XI, p. 249, 1898; *op. cit.*, vol. XIII, p. 543, 1900.

Crangon formosus HAY and SHORE, Bull. U. S. Bur. Fish., vol. 35, p. 384, pl. 26, fig. 5, 1918.—SCHMITT, Univ. Iowa Studies Nat. Hist., vol. 10, No. 4, p. 73, 1924; Bidjr. tot Dierk., Amsterdam, Afl. 23E, p. 65, 1924.

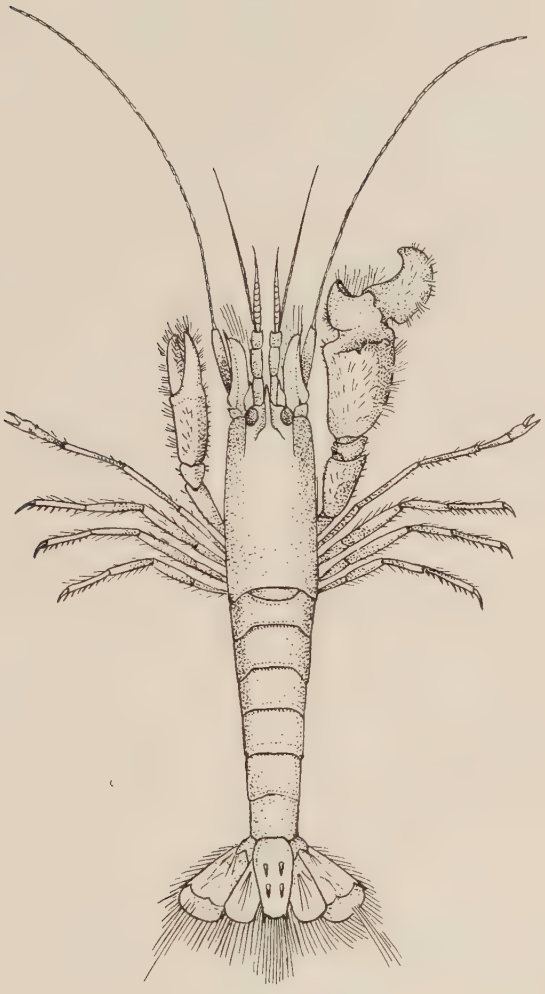
Alpheus formosus or *Crangon formosus* A. E. VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 84, pl. 19, figs. 1, 2, pl. 20, fig. 3, pl. 23, figs. 5, a, b, pl. 29, figs. 4, a-u, pl. 25, figs. 6-6a (type of *A. poeyi*); text figs. 5d and 6a, 1922.

Alpheus panamensis ZIMMER, Zoöl. Jahrb., Suppl. 11, heft 3, p. 391, text figs. N-V, 1913.

Alpheus armillatus H. Milne Edwards.

Plate 60.

TYPE: The type came from the Antilles and is deposited in the Paris Museum.



Alpheus armillatus H. Milne Edwards, ×1.5.

DISTRIBUTION: A reef dweller. Known throughout the West Indian region as far north as Beaufort, N. C., and southward to Brazil.

MATERIAL EXAMINED: One specimen taken in dragnet in 2 fms., Port Antonio, Jamaica, February 17, 1926, by the *"Ara."*

COLOR: In life this sponge shrimp has the body brownish-grey, or grey, somewhat darker on the abdomen, transversely banded with nine, occasionally ten, elliptical, incomplete bands of creamy white, of about the same width as the same alternating grey bands. On some specimens the six creamy bands on the abdomen are bordered with a fine line of orange, which line also frequently margins the caudal fan. The antennal peduncle is greyish, the flagella and ambulatory legs orange, banded alternately with white. The chelipeds are usually pale, thickly speckled with grey with two or three transverse white bands on the upper surface, the finger-tips either delicate salmon or whitish.

TECHNICAL DESCRIPTION: Animal very robust; the great cheliped large and superficially much like that of *Crangon heterochaelis.* Carapace 11.5 mm. long, including the rostral tooth, which is 1 mm. long. Rostral tooth slender, spine-like, projecting beyond the frontal margin about one millimeter and continuing posteriorly as a ridge for about twice that distance where the terminating ridge meets the apex of a flat, lanceolate process whose lateral margins are sharply defined by a ridge which is posteriorly confluent with the definition of the orbital lobe which is convex dorsally, with the frontal margin also convex; there is a sulcus on either side between the rostral ridge and the orbital lobe. The abdominal segments have the epimera only moderately developed; the telson is one and two-fifths times as long as the sixth segment, moderately tapered and rounded distally and ciliated, with two pairs of submedian, short, articulated spines on the dorsal surface. The caudal fan has each blade slightly longer than the telson, and heavily ciliated marginally; the inner blade is wider than the telson, broadly oval; its distal margin evenly rounded. The outer blade is also oval but larger than the inner, with the distal portion transversely articulated and a small spine on the distal angle of the lateral margin of the proximal portion of the blade; there is an oblique longitudinal ridge on the dorsal surface of this blade.

The antennulae have the basal article broad and scarcely extending beyond the rostral spine; the second article is one and one-half times as long as the first, cylindrical; the third peduncular article is scarcely three-fifths as long as the second, stocky; the flagellum is biramose;

the shorter whip is about an inch long and consists of stocky rings for the proximal half and attentuated rings the remainder of its length; the longer whip is nearly three times as long as the shorter branch, being approximately as long as the antennal flagellum.

The antennae have a very short proximal article, the scaphocerite is about one millimeter longer than the antennular peduncle, the outer lateral ridge thickened, with the tip spinous, the scale narrow, not quite as wide proximally, very tapered distally and ciliated along the inner and distal lateral margins. The carpocerite is slender, cylindrical, exceeding the length of the antennular peduncle by about the length of the third peduncular article; the flagellum is slender, slightly longer than the body.

The first chelipeds are large, both hairy; the right one twice as long and conspicuously larger than the left, the right one having the palm about as long as the carapace, rather compressed, its height being one-half its length. There is a deeply channelled, transverse groove on the upper surface of the palm, subdistal to the margin behind the base of the finger; a slighter, crooked surface runs back from the dorsal groove for about half the length of the lateral faces of the palm; below and parallel but not confluent with the dorsal sulcus, there is a deeper constriction on the lower surface, at the base of the finger. The lower finger is stout, excavate proximally, the lateral walls on each side encupping the upper finger, the apex of the lower finger is short, acute. The upper finger is curved, beak-like, with an acute tip and an enormous basal molar. The small chela has the carpus cup-like, the palm of the propodus about as long as the finger, three-fifths as high as long, with a light, transverse sulcus at the base of the propodal finger; the fingers are approximately subequal, long, slender, meeting throughout their length.

The second legs are extremely slender, almost as long as the smaller first leg; the carpus of the second leg has the first article two-thirds as long as the merus; the second article three-fourths as long as the first; the third and fourth articles subequal, each one-half as long as the second article; the fifth article is a third longer than the fourth; the propodus is of about the same diameter as the carpus, the palm being one-half the propodal length; the fingers are slender, corneous tipped.

The third, fourth and fifth pairs of legs are successively shorter, compressed; the propodus armed on the ventral surface with a double row of seven each, sharp articulated spines; the dactyl is three-fifths

Alpheus heterochaelis Say, ×2.

as long as the propodus, curved, laterally concave, acuminate. The fifth pair of legs is substantially shorter than the fourth, but otherwise similar.

SYNONYMY.—*Alpheus armillatus* H. MILNE EDWARDS, Hist. Nat. Crust., vol. II, p. 354, 1837.—COUTIÈRE, Ann. Sci. Nat., series 8, vol. 9, p. 129, fig. 117, 1899; Proc. U. S. Nat. Mus., vol. 37, p. 485, 1910.—VERRILL, Trans. Conn. Arts and Sci., vol. 26, p. 73, pl. 20, fig. 4b, pl. 21, figs. 4-4a, pl. 26, figs. 1-1d, pl. 27, figs. 1-1s, 1922.

Alpheus lancirostris RANKIN, Ann. N. Y. Acad. Sci., vol. 12, p. 541, pl. 17, fig. 5, pl. 17, fig. 5, 1900.

Crangon armillatus HAY and SHORE, Bull. U. S. Bur. Fish., vol. 35, p. 386, pl. 27, fig. 1, text fig. 9, 1918.—SCHMITT, Univ. Iowa Studies Nat. Hist., vol. 10, No. 4, p. 76, 1924.

Alpheus heterochaelis Say.

Plate 61.

TYPE: Say founded the species on material from South Carolina and a specimen from Amelia Island, Florida.

DISTRIBUTION: Known from Beaufort, N. C., southward throughout the West Indian region to Maceio, Brazil. Taken at the Bermudas, in Porto Rico, Curaçao and Barbados.

MATERIAL EXAMINED: Two specimens taken at Pigeon Key, Florida, by the *"Ara,"* William K. Vanderbilt, commanding.

COLOR: See the color plate of Brooks and Herrick.

TECHNICAL DESCRIPTION: Animal robust, superficially resembling *C. armillatus,* from which it may at once be separated by the different rostrum, and differently placed grooves on the cheliped. The rostrum is simple, a linear ridge, projecting the distal third of its length beyond the frontal margin as an acute spine and continuous posteriorly as far as the base of the orbital lobes, from which it is separated by a deep sulcus; the ocular lobe is convex, rounded on the frontal margin. The carapace and abdominal segments are very similar to those of *C. armillatus* except that the telson of *C. heterochaelis* is substantially wider in proportion to its length than is that of an *armillatus* of the same size and sex.

The antennulae have the first article two-thirds as long as the second, and the second article twice as long as the third article.

The antennae have the scaphocerite with a shorter, acuminate tooth at the distal margin and the scale slightly wider, and its distal half with the margin more rounded than does *armillatus;* the carpocerite

is a little shorter in *heterochaelis* in relation to the scaphocerite than is the case in *armillatus.*

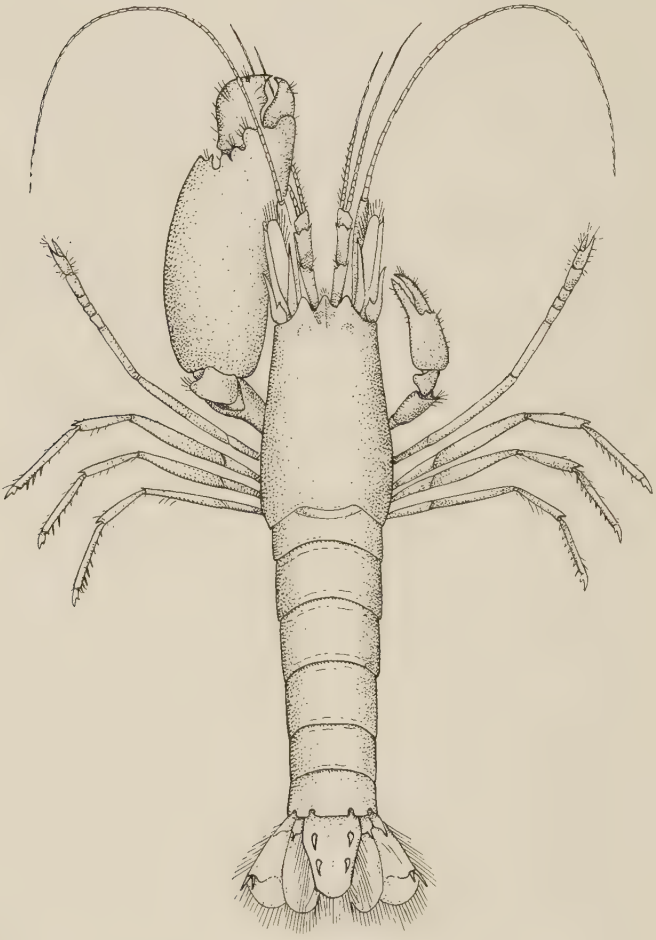
The large cheliped of *heterochaelis* is shorter than that of *C. armillatus;* the upper and lower transverse grooves are somewhat similar but the supermarginal groove of the inner face of *heterochaelis* is conspicuous. The grooves and furrows of the dactyl are distinctly different, and the shape of the great basal tooth of the hinged finger and correspondingly the shape of the excavation on the lower finger are also distinctive.

The smaller chela in the male is broad, elongated. The palm is of about equal length to the curved dactyl. The proximal dorsal area of the palm is circumscribed by an impressed line; the upper, distal margin is notched and a groove runs back from the notch on either side; the groove of the inner side is deeper and joins the posterior impressed line; the distal articular margin is tridentate; the upper, median tooth is small, obtuse, the lateral ones are more acute; these teeth are frequently brownish-black like the tips of the fingers. The upper finger is broad, arched, beak-like; the lower finger has the tip bent upward slightly, the cutting edge excavate, while that of the hinged finger is produced to a median carina.

The third and fourth pairs of ambulatory legs are moderately compressed, the ischial spine inconspicuous or more often lacking; the propodus armed with eight or nine small, articulated spines; the dactyl is flattish, curved, acute. The fifth legs are smaller, nearly terate; the dactyl similar to those of the preceding pairs.

Synonymy.—*Alpheus heterochaelis* Say, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 243, 1818.—H. Milne Edwards, Hist. Nat. Crust., vol. II, p. 356, 1837.—Gibbes, Proc. Amer. Assoc. Adv. Sci., vol. 3, p. 196, 1850.—Kingsley, Bull. U. S. Geol. and Geograph. Surv., vol. 4, p. 194, 1-878; Bull. Essex Inst., vol. X, p. 58, 1878; Proc. Acad. Nat. Sci. Phila. for 1880, p. 417, part; Bull. Essex. Inst., vol. 14, p. 120, 1883.—Brooks and Herrick, Johns Univ. Circ., vol. 11, pp. 69-70, 1892 (life history); Mem. Nat. Acad. Sci., vol. V, pp. 361-463, pl. 2, colored; pls. 16-20, 1892 (Embryology and life history).—Rathbun, Proc. Wash. Acad. Sci., vol. 2, p. 152, 1900; Bull. U. S. Fish. Comm., vol. 20, pt. 2, p. 197, 1901, part.—Coutière, Proc. U. S. Nat. Mus., vol. 37, p. 485, 1910.

Crangon heterochaelis Hay and Shore, Bull. U. S. Bur. Fish., vol. 35, p. 386, pl. 26, fig. 6, 1918.—Schmitt, Bidj. tot der Dierk., Amsterdam, Afl. 23E, p. 65, 1924.



Synalphcus brevicarpus (Herrick), ×3.

Genus: **SYNALPHEUS** Bate.

Synalpheus brevicarpus (Herrick).

Plate 62.

TYPE: Collected in a green sponge, found on the reefs of Bahama Islands.

DISTRIBUTION: Known from Florida, the Bahamas, Curaçao and Porto Rico. The *"Ara"* specimen establishes the first record of the species from Haiti.

MATERIAL EXAMINED: One specimen, an ovigerous female, taken at Carenge Bay, Le Mole, Haiti, February 4, 1924, by the *"Ara."* One female, ovigerous, from Pigeon Key, Fla., April 7, 1923. A male and an ovigerous female from Limon Bay, Panama, 1928.

TECHNICAL DESCRIPTION: Female: Animal robust, carapace about 15 mm. long, abdomen about 28 mm. long. Teeth of the frontal margin three, each an equilateral triangle, the median tooth slightly in advance of the submedian teeth, from which it is separated by a shallow U-shaped sinus. Eyes subcircular, shielded, one each behind the lateral tooth. Abdomen stout, with the epimera well developed, rounded, forming a deep brood pouch. Telson one and one-half times as long as the preceding segment, wider basally, narrowing distally, the terminal margin convex and armed on each side with two spines at the postlateral angle and margin ciliated. Two pairs of submedian spines, articulated, occur on the dorsal surface of the telson. The peduncle of the caudal fan is produced to a slender, attenuated spine at the outer angle and has a smaller spine at the outer angle of that portion of the peduncle above the inner blade. Both blades are broadly oval, the outer one wider than the inner and armed with two articulated teeth at the outer distal angle. Both blades are heavily ciliated with stiff, close-set hairs.

The stylocerite is very slender, extending to two-thirds of the length of the fourth peduncular segment and has the proximal outer lateral margin a trifle convex, thence converging in an oblique line to the very slender, acuminate apex. The third and fourth antennular articles are elongate, subequal; the fifth article is about half as long as the first; the outer whip is a trifle thicker basally and shorter than the inner whip by about twelve rings.

The antennae have the basicerite angulated at the inner distal margin, the outer part produced into a tapering, acuminate process that reaches halfway the length of the thickened outer lateral margin of the scaphocerite. The carpocerite is slender, cylindrical, the distal

fourth of it reaching beyond the distal margin of the scaphocerite. It is more regularly cylindrical than that of *S. minus*. The scaphocerite has the scale regularly oval, 5.5 to 6.5 times as long as wide, the distal margin rounded, ciliated; the lateral spine is thick, acuminate and does not extend beyond the distal margin of the scale, while in *S. minus* it is longer.

The female great chela is about 18 mm. long, 6.3 mm. greatest length; the upper like a parrot's beak, about 3.6 mm. long, the tip horny. The palm tapers more proximally than in *S. minus*. The small chela is approximately a third of the larger in size with the fingers four-fifths as long as the palm and slenderer than are those of *S. minus*.

The second legs have the merus elongate, four and one-fourth times as long as its greatest width; the carpus one and one-fourth times as long as the merus, cylindrical, multiarticulate, consisting of one very long joint followed by three subequal, short ones, and another article twice as long as the preceding short one; the propodus is one and one-third times the length of the last carpal article with the fingers weak, bristly.

The third, fourth and fifth pairs of legs are similar except that the meral joints of the third leg are wider in ratio to their length than are those of the fourth leg, while the latter is a little wider than that of the fifth leg. The merus of the third leg is three and one-half times its greatest width; the carpus is about half as long as the merus; the propodus is about three-fourths as long as the merus and armed on its inferior lateral margin with seven articulated spines; the dactyl is short, scarcely one-fourth the length of the propodus, curved, with deeply bifid tip.

The present female is carrying about 150 to 200 oval eggs.

Synonymy.—*Alpheus saulcyi* var. *brevicarpus* Herrick, Mem. Nat. Acad. Sci., vol. V, p. 383, 1891.

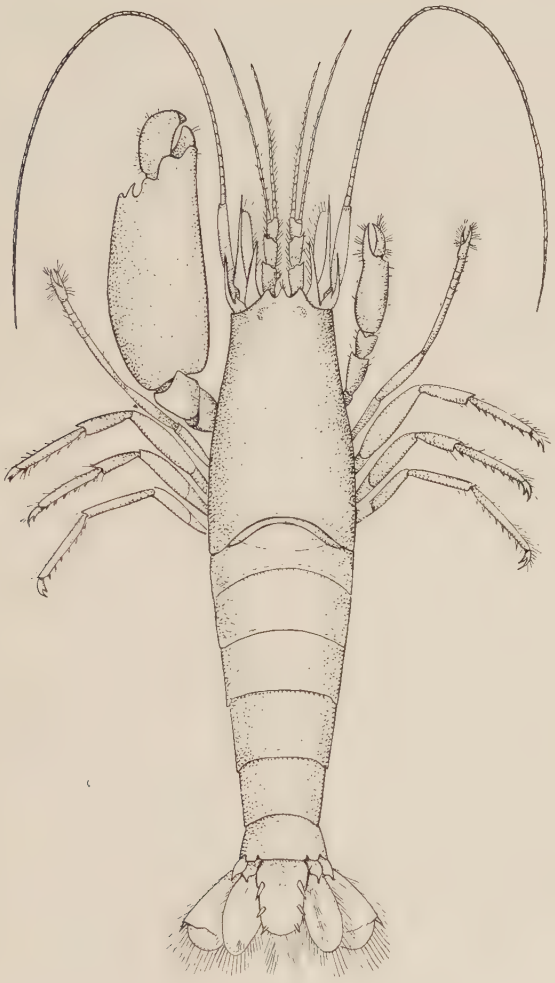
Synalpheus brevicarpus Coutière, Proc. U. S. Nat. Mus., vol. 36, p. 51, text fig. 29, *a* to *t'*, 1909.—Schmitt, Bijdragen tot de dierkunde, Natura artis magistra, Amsterdam, 23E, Afl., 1924, p. 67.

Synalpheus minus (Say).

Plate 63.

Type: "Inhabits coasts of the southern states and east Florida"; deposited in the Philadelphia Academy, 1818.

Distribution: A reef-dweller in the West Indian region, found abundantly from Florida, the Bahamas, Porto Rica, Bermudas, and at Bahia, Brazil. Two subspecies of this form have been described.



Synalpheus minus (Say), ×3.4.

MATERIAL EXAMINED: Young, ovigerous female specimen found in loggerhead sponge, Knight's Key, Fla., in 2 fms., March 6, 1925, by the *"Ara."*

TECHNICAL DESCRIPTION: This species is very closely related to *S. brevicarpus,* from which it may be distinguished by the following differences:

The three frontal teeth are equilateral triangles separated by a shallow U-shaped sinus; the median tooth is a trifle slenderer than the lateral. The abdomen is stout; the epimera broadly rounded. The eyes are covered, situated behind but near the frontal margin and not raised in convexities, beyond the surface of the lateral tooth. The antennulae have the first peduncular article twice as long as the second, which in turn is one and one-half times as long as the third article; the flagellum is two-branched, the external branch bifurcating at the external tenth article. The stylocerite is very acuminate, distally reaching to about midway the second peduncular article of the antennulae. The basicerite is very acuminate, the lateral spine constantly longer than its proximal width; the spine extends as far forward as the basal antennular article. The scaphocerite is narrow, the thickened outer lateral spine acuminate, reaching as far forward as the distal margin of the peduncle of the antennulae; the scale is narrow, with the inner lateral margin tapering distally; the terminal margin obliquely convex and heavily ciliated. The carpocerite is a little longer than the scaphocerite and extends beyond the antennular peduncle by a distance equal to about three-fifths of the last peduncular article.

The great cheliped is stout, regularly ovoid, armed with a small, sharp spine on the inner distal upper margin at the base of the hinged finger. The dactyl is broad, the upper margin curved, the tip obtuse, the cutting edge sinuous. The propodal finger is smaller. The smaller chelae is not quite one-third the size of the larger, the palm narrowly elliptical with slender, acute, down-curved fingers, set with several small tufts of setae.

The third, fourth and fifth legs are slender, the ratios as figured.

SYNONYMY.—*Alpheus minus* SAY, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 245, 1818.

Synalpheus minus COUTIÈRE, Proc. U. S. Nat. Mus., vol. 36, p. 43, text fig. 23, 1909.—VERRILL, Trans. Conn. Acad. Arts and Sci., vol. 26, p. 102, pl. 21, fig. 1, pl. 23, figs. 4, 4a, 5, 5a, pl. 24, figs. 2-2n, pl. 26, figs. 1, 1d, 2 (variety); pl. 31, fig. 4, and pl. 25, fig. 3, pl. 47, figs. 1-1c, fig. 2, pl. 48, figs. 3-3c (with full synonymy).

Synalpheus fritzmulleri Coutiére.

Plate 64.

TYPE: From Florida, Cat. No. 6970, United States National Museum. An additional series of typical specimens, are also in this Museum, chiefly from Florida and West Indian stations, but also including one from Lower California.

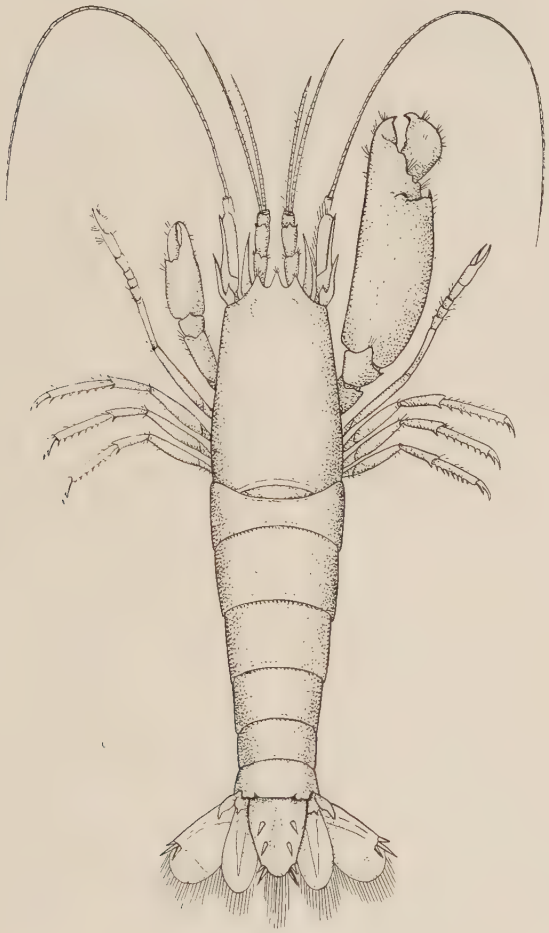
DISTRIBUTION: West Indian region, as far north as Fort Macon, Ga.; Lower California, represented by a single station.

MATERIAL EXAMINED: One specimen, collected on Pigeon Key, Fla., by the *"Ara."*

TECHNICAL DESCRIPTION: This species was named for the naturalist, Dr. Fritz Muller, and designated by Dr. Coutiére as representative of his Neomeris group of the Synalpheidae. The rostral spine is slender, slightly longer than the orbital spines and well separated therefrom, with the proximal part of its margins subparallel, convergent distally; the orbital spines are acute, reaching to about the middle of the basal antennular article. The sinus between the spines is U-shaped; the eyes are subcircular, shielded. The carapace is robust, glabrous, the abdomen stout, the epimeral regions well developed, especially in the female, forming a deep brood pouch. The telson is one and three-fourths times as long as the preceding segment, the outer distal angle obtuse, armed with two acute movable spines on each side, the inner spine being twice as long as its companion, acute; armed on the dorsal surface with two pairs of articulated spines; the distal margin slightly convex, fringed with about twenty setae. The outer blade of the uropoda has three flexible spines at the subdistal terminus of the outer lateral margin.

The stylocerite is very narrow and acuminate, its tip reaching to slightly beyond the middle of the second antennular article. The antennules have the peduncular articles as illustrated; their ratio 1.5, 1.1, 1, beginning at the base; the outer flagellum bifurcates at about the eighth ring.

The antennal basicerite bears on its inner dorsal distal angle an acute spine and at its outer lateral distal angle a much longer acute spine about three-fourths as long as the stylocerite with its tip slightly outward curved. The scaphocerite is about equal in length to the antennular peduncle and has the thickened outer lateral border



Synalpheus fritzmulleri, ×2.

sharply defined and terminating distally in an acute spine which reaches as far forward as the carpocerite; the blade is curved as figured. The carpocerite ends beyond the antennule by about half the length of the distal antennular article, and is about one-third as wide as long, slightly swollen.

The external maxillipeds when extended, reach as far forward as the ninth annulation of the outer antennular flagellum.

The large cheliped is slightly longer than the carapace, oblong-ellipsoidal, only moderately swollen in the middle and with a small tooth on its outer distal margin, from which a furrow runs inward halfway the width of the inner face of the palm. The total propodal length is about three and a third times its medial width. The carpus is short, cup-like, prolonged downward; the merus stout with a spine-like point at its inferior distal angle. The smaller cheliped resembles the larger, but has its finger more slender, tapered.

The second legs are slender; with the carpus five-jointed, the first article equal in length to the other four combined; the second article one and one-half times as long as the third; the third and fourth articles subequal; the fifth article subequal to the second; the cheliped with the fingers a little longer than the palm.

The third, fourth and fifth pair of legs have the ratios as illustrated. The merus of the third leg is 3.5 times longer than wide, the carpus slender, the propodus elongate, slender, armed along its inner lateral margin with about seven acute spines; the dactyl less than half as long as the propodus, its outer margin convex, its inner margin concave, the tip bifid, the outer hook curved, slightly longer than the inner, which latter tooth is thicker.

Dr. Coutiére described one variety of this species designated *elongatus,* from South Carolina and Florida; Dr. Verrill added a second variety, *caribaea,* from Dominica Island, and a third variety, *carolinensis* from Fort Macon. I now have a fourth variety from Haiti, *gonavensis* Boone, in manuscript.

Synonymy: *Synalpheus fritzmulleri* Coutiére, Proc. U. S. Nat. Mus., vol. 36, p. 36, text figs. 18*a* to *t*, text fig. 19, variety *elongatus,* 1909.—Verrill, Trans. Conn. Acad. Arts and Sci. vol. 26, p. 97, pl. 22, fig. 6, pl. 29, figs. 1-1d, figs. 3a to c, text fig. 8, 1922.—Schmitt, Bijdragen, tot de Dierkunde, Natura Artis Magister, Amsterdam, Afl. XXIII, p. 66, 1924.—Zimmer, Zool. Jahrb. suppl. 11, heft 3, p. 382, 1913.

Synalpheus longicarpus (Herrick).

Plate 65.

TYPE: Collected in the Bahama Islands, inhabiting the tubes and cavities of two species of sponge, a green and a brown kind.

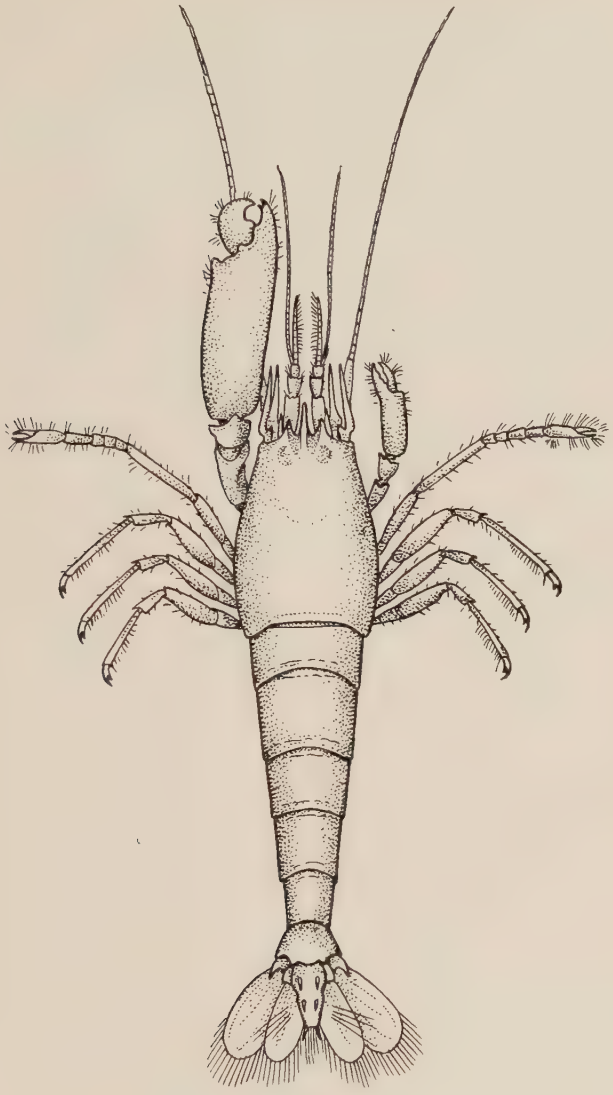
DISTRIBUTION: Frequently inhabits the loggerhead sponge. Reported from North Carolina, Florida, the Gulf of Mexico, Yucatan, Porto Rico, Jamaica, Curaçao and Haiti.

MATERIAL EXAMINED: Five specimens, taken from sponge, Carenge Bay, Le Mole, Haiti, February 4, 1924, by the *"Ara,"* William K. Vanderbilt, commanding.

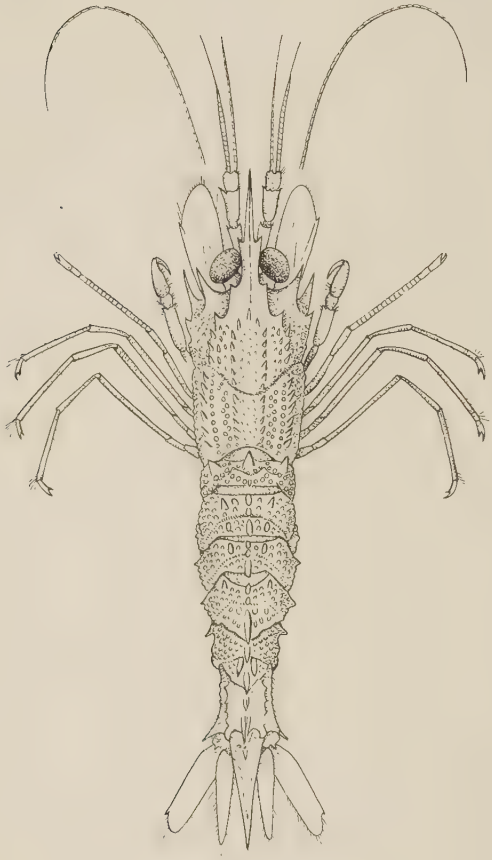
TECHNICAL DESCRIPTION: Rostrum a little longer than the obtuse, triangular orbital spine and extending two-fifths of the length of the first antennular article and separated from the orbital spine by a V-shaped sinus. The cornea are well defined, blackish. The antennulae have the basal article one and one-half times as long as the third article. The acuminate stylocerite reaches the distal margin of the third basal article. The carpocerite is slender and cylindrical, slightly excurved, five or five and a half times as long as wide and extending beyond the antennular peduncle by about the length of the third antennular article. The scaphocerite has the lateral spine strong, acute, usually exceeding the length of the antennular article by about half the length of the third article. The scale is rudimentary, when present, usually no longer than the basal antennal article and less than half as wide as the lateral spine; frequently entirely obsolete.

The sixth abdominal segment is produced on the posterior angle to a strong triangular lateral tooth. Both branches of the uropoda are wide, convex, a little longer than the telson. The telson is longer and narrower than that of *S. goodei,* with the tip very narrow and slightly rounded and ciliate.

The great cheliped is ovate, elongated, the margin moderately convex, the posterior part dilated and prolonged backward beyond the articulation; the carpus is small, cup-like, beyond the central axis of the palm. There is a small, acute spine at the anterior distal, dorsal margin of the palm. The fingers are strong, about one-fourth the total length of the palm; the dactyl is a trifle oblique distally. The larger claw is two and one-half to three times as long as the smaller one; the latter has the propodal finger with two short, angular prominences in addition to the apex; the dactyl has two teeth, the lower of which is the stronger. The carpus varies in length. The merus is about four times as long as wide.



Synalpheus longicarpus (Herrick), ×3.



Glyphocrangon aculeata A. Milne Edwards, natural size. Specimen with average size pterygostomian spine.

The second legs have the merus twice as long as the first carpal article, which is about one-fifth shorter than the total of the other four articles. The terminal claw is longer in the male but shorter in the female than the last four carpal articles and is tufted with setae.

The third legs are also stronger in the male than in the female; the merus is about three and one-half times longer than wide; the propodus is armed on its inferior lateral margin with eight sharp spines; the dactyl is short, curved, subequally bifid.

SYNONYMY.—*Alpheus saulcyi* var. *longicarpus* HERRICK, Mem. Nat. Acad. Sci., vol. V, p. 383, part, 1892.

Synalpheus longicarpus COUTIÈRE, Proc. U. S. Nat. Mus., vol. 36, p. 53, text figs. 3-, a-u, 1909.

Family: GLYPHOCRANGONIDAE.

Genus: GLYPHOCRANGON A. Milne Edwards.

Glyphocrangon aculeata A. Milne Edwards.

Plates 66, 67.

TYPE: This exquisitely sculptured species was taken by the *"Blake"* at six stations in the West Indies, at depths ranging from 322 to 955 fathoms. The type material is divided between the Museum of Comparative Zoölogy and the Paris Museum.

DISTRIBUTION: Known throughout the West Indian region, from the above cited *"Blake"* stations in the upper West Indies to the *"Challenger"* record, off Pernambuco. The *"Pawnee"* captured 49 specimens of this species in the vicinity of Glover Reef, in 484 fms.

MATERIAL EXAMINED: Thirteen specimens, four of which are ovigerous, dredged in 1100 fathoms, off Miami, Florida, March 3, 1926, by the *"Ara,"* establishes the most northern record for the species, as well as the greatest depth at which it has been captured.

TECHNICAL DESCRIPTION: Animal 88.5 mm. long; rostrum 15 mm. long from tip to postorbital angle; carapace 22.5 mm. long from orbital angle to posterior margin. Abdomen about 51 mm. long.

Rostrum sharp, recurved and convex for the anterior three-fifths of its length, the proximal part broad, concave, widening posteriorly, ornamented with a pair of spines, one on each margin, anterior to the eyes and a second pair posterior to the orbital angle and just in advance of the first transverse groove. There are eight longitudinal carinae on the carapace, the submedian pair of which are continuous with the posterior lateral margin of the rostrum and which is com-

posed of a series of about ten forward-directed teeth, seven of which are anterior to the deep cervical groove. The antennal spine is sharp, upward-directed and well developed; the pterygostomian spine is longer and points downward and forward, is very acuminate and laterally compressed, while the hepatic spine is the most prominent of the three. Of the thirteen specimens before me, ten have the hepatic spine as shown in the figure, while the remaining three have this spine wider, as shown in the photograph. The average hepatic spine is wide, laminate proximally, flaring outward with an acuminate apex. The upper lateral carinae are denticulate anterior to the cervical groove, but posterior to it form a single long ridge. The median lateral carinae consist of a conspicuous, laminate ridge, which terminates anteriorly just behind the clear-cut cervical fossa, in a small, sharp tooth which is in line with the big hepatic tooth. The lower lateral carinae are also unbroken except by the cervical fossa. The hepatic suture is deep, uniting with the cervical groove anteriorly.

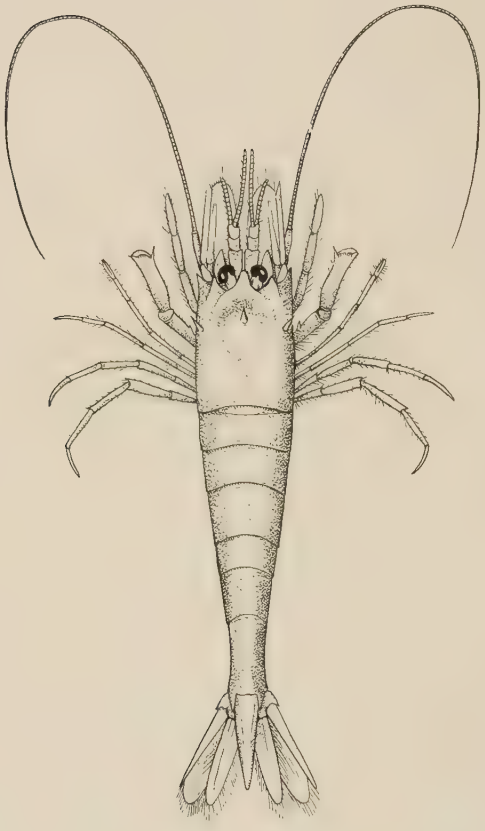
The first abdominal segment is ornamented with three sharp, forward-directed spines, one in the median dorsal line and one on each side, in line with the upper lateral carina. The second to sixth segments, inclusive, each bear in the median dorsal line, two laminate teeth, one behind the other, and separated from each other by the decidedly transverse groove ornamenting the respective segments. This dorsal carina is very pronounced and terminates posteriorly in a pointed tooth projecting above the telson. The remaining surface of the abdomen is very coarsely tuberculate. The epimeral margin of the first segment has one tooth; of the second to fifth segments, inclusive, each segment has two sharp teeth, the hinder tooth of the fifth epimera being quite sharp and flaring as is also the only tooth of the sixth segment. The telson is very acuminate, with the tip upcurved; there is a distinct median dorsal groove margined by a carina, which in turn is separated by another groove from the carinate lateral margin. The rhipidura is composed of a very small peduncle and the blades are not quite as long as the telson, the inner blade narrow, unequally ovate, quite tapering distally, the outer blade more widely oval distally; both with ciliated margins.

The eyes are large, globular.

The antennulae are nearly as long as the carapace, biflagellate, the outer branch being conspicuously thicker than the inner.

The antennae have a scaphocerite which is oar-blade shaped, about

Glyphocrangon aculeata A. Milne Edwards. A, female, with eggs; B, specimen with greatly developed pterygostomian spine.



Crangon septemspinosa Say, natural size.

as long as the antennular peduncle, with the margins ciliated. The flagellum is a little longer than the body of the animal.

The external maxillipeds are stouter than the first legs and with the distal margin acuminate and armed along both lateral margins with a series of long, articulated spines, and a few of these are also present on the inner face of the article.

The first legs are robust, with the propodus rather stout, armed on the upper lateral margin with several tufts of bristles. The dactyl is about one-half as long as the propodus, slender, curved, acuminate, closing upon the propodus like a claw.

The second legs are chelate, very long and slender, with a multi-articulate carpus consisting of about twenty joints; the propodus is scarcely longer and of no greater diameter than the distal carpal article; the dactylus is small, curved, less than one-third of the length of the palm of the propodus, toothed distally and closing upon the propodal finger.

The third, fourth and fifth legs are monodactyl, of nearly equal length, slender, each with the ischium nearly one-half as long as the elongate merus, with a subdistal tuft of stiff setae, which stands out fan-wise, encircling the base of the dactyl.

The latter is scarcely two-fifths as long as the propodus and is dorsoventrally flattened, with these surfaces concave between the carinate margins which converge distally to a sharp point.

SYNONYMY.—*Glyphocrangon aculeatum* A. MILNE EDWARDS, Ann. Sci. (6), tome 11, p. 5, 1884.

Glyphocrangon aculeata SPENCE BATE, Rept. Voy. *"Challenger,"* Zoöl., vol. 24, p. 521, pl. 94, fig. 1, 1887.—BOONE, Bull. Bingham Oceanog. Coll., vol. 1, art. 2, p. 121, text fig. 27, 1927 (and notes on ecdysis).

Family: CRANGONIDAE.

Genus: CRANGON Fabricius.

Crangon septemspinosa Say.

Plate 68.

TYPE: Say's type came from the coasts of the southern United States; he notes that it is found as far south as east Florida, common in the bay shores and inlets of the sea.

DIAGNOSTIC CHARACTERS: This *Crangon* is closely allied with the *Crangon vulgaris* of European waters, from which it differs only in

the shape of the scaphocerite. In *septemspinosa* this scale is narrower at its distal end and the margin of this rounded part slopes backward from the inner angle, while in *C. vulgaris* this same margin is convex and tends to slope forward towards the inner angle. In *septemspinosa* the distal spine of the scaphocerite is as long or longer than the distal margin of the rounded portion.

Distribution: Known from the eastern coast of North America from eastern Florida northward to south Greenland and from the Arctic coast of Alaska at Eschscholtz Bay, southward along the eastern coast of Bering Sea to the Shumagin Islands.

Material examined: Three specimens dredged in Beaver Harbor, Nova Scotia, September 10, 1926.

Technical description: Carapace short and wide; abdomen two and three-fifths times as long as carapace, very robust. Rostrum short, not extending as far forward as the eye, tongue-like, with the apex rounded and the upper surface concave, the margin continuous posteriorly with that of the orbit and midway behind the eye continuous with a ridge which curves outward and then runs backward three-fourths the length of the carapace. The postorbital spine is acute, triangulate, upward-directed slightly, but closely appressed to the eye. The pterygostomian spine is rather large, triangulate, forward-directed. There are three other spines on the carapace, one in the median line of the mesogastric region, small, acute, upward and forward-directed, and in line with this a similar spine on either side in the midlateral region, the hepatic spine; there is a slight oblique carina running from the anterior base of the hepatic spine to the lower side of the suborbital spine.

The first and second abdominal segments are wide, of equal length, each being 4 mm. long, with the pleura but little produced; the pleura of the first segment have the margin concave above the leg and rounded at the corner angles, the posterior angle being convex and slightly produced posteriorly; the second pleura are produced into a convex flap anteriorly and posteriorly, overlapping the adjacent segments, and with the outer margin slightly concave above the leg; the third segment is nearly as long in the median line as the first two taken together, being 7.5 mm. long, with the lateral margin convex, overlapping the fourth segment; the fourth segment is only 3.5 mm. long with the pleural margin convex and ciliate; the fifth segment is 5 mm. long, with the posterior median margin straight, a small notch at the base of the pleural margin, which latter is directed obliquely

back, its outer lateral margin slightly convex, the sixth segment is 9.5 mm. long, with the lateral margin straight, a small spine at the lower posterior distal angle; a triangular process on each side on the base of the telson, the median posterior margin straight. The telson is 9.5 mm. long, or about 3 mm. shorter than the uropoda, with the upper surface convex, the distal margins rounded and ciliated.

The peduncle of the uropoda is produced into a small, triangular process above the base of the inner blade and a much larger, triangulate process above the outer blade; the blades are subequal in length, the inner one regularly oval and slightly the narrower, with a median longitudinal ridge and with the margins ciliated. The outer blade is the wider, with a light median keel and also with a heavier keel running obliquely to the subdistal spine of the outer lateral margin; the distal margin is convex, ciliated.

On the ventral surface there is a very acute, conical, forward-directed spine in the median line at the apex of the sternal plastron. In the median line of each the first, second, third, fourth and fifth segments there is a short, downward-directed spine placed between the pleopoda, and at the median posterior margin of the sixth segment there is a sharp, conical spine directed straight back.

The eye is short, close-set, projecting only slightly beyond the rostrum; the stalk has a small, tongue-like projection, tipped with a low tubercle on the cornea; the cornea is terminal, spherical, made up of very fine hexagonal facets.

The inner antennae have the peduncular article short, shallowly excavate beneath the eye; with a large, lobate process on the outer side, protecting the eye; the second and third articles short, compressed dorsoventrally, the flagellum with the outer whip the thicker, composed of 38 rings and fringed on the lower margin with long, plumose setae; the inner flagellum consists of a basal article two-thirds as long as the outer whip and 25 short articles and is also very setose on both margins.

The antennae have a short, basal article, with a rounded triangle showing on the upper surface and a small spine at the outer distal angle which is shorter than the pterygostomian spine; the scaphocerite is large with the outer margin thickened and terminating distally in an acute triangulate spine which extends beyond the inner convex lobe of the scaphocerite. There is also a median longitudinal rib in the scaphocerite. The second article is short, the third long, slender, cylindrical; the flagellum is very slender, multiarticulate, 65 mm. long.

The external maxillipeds are strong, leg-like, the two distal articles slender, subequal in length and heavily fringed with bushy setae.

The first legs are chelate, the merus long, compressed, cylindrical, with an acute spine almost in the anterior lateral margin almost midway and a smaller, acute spine at the distal margin of the posterior margin; the carpus is short, with two spines on the lower distal margin, the upper surface convex, with a blunt tooth at the median angle and another at the inner carpal angle; the propodus is long, dorsoventrally flattened, nearly rectangular, with the distal margin slightly oblique and convex and with a sharp, outward-directed spine at the inner distal angle; the short, curved dactyl is attached at the outer distal angle and fits across this curved end of the propodus, its tip crossing upon the base of the propodal spine or finger.

The second legs are extremely slender, obscure, slightly longer than the first pair; merus and carpus both very slender, greatly elongated, subequal; the carpus is one and a half times as long as the propodus; the propodus is small, two-thirds as long as the carpus, the dactyl composing one-fifth to one-third of this length, feeble, with the distal margin dentate and furnished with numerous fine, bristly setae.

The third legs are decidedly weaker than the fourth and fifth pairs which they otherwise resemble; the merus and carpus are subequal; the propodus is one and two-fifths as long as the carpus; the dactyl is needle-like, three-fifths as long as the propodus, exceedingly acuminate.

The fourth and fifth legs are more robust and have the dactyl longer in proportion to the carpus.

Synonymy.—*Crangon vulgaris* A. S. Packard, Canadian Nat. and Geol., vol. 8, No. 6, Dec., 1863, p. 418; Mem. Boston Soc. Nat. Hist., vol. 1, 1866-69, p. 302.—Whiteaves, Catal. Marine Invert. Eastern Canada, Geol. Surv. Canada, Ottawa, 1901, p. 252. Frequently confused with *Crangon crangon* (Linné) and *Crangon vulgaris* Fabricius by various authors.

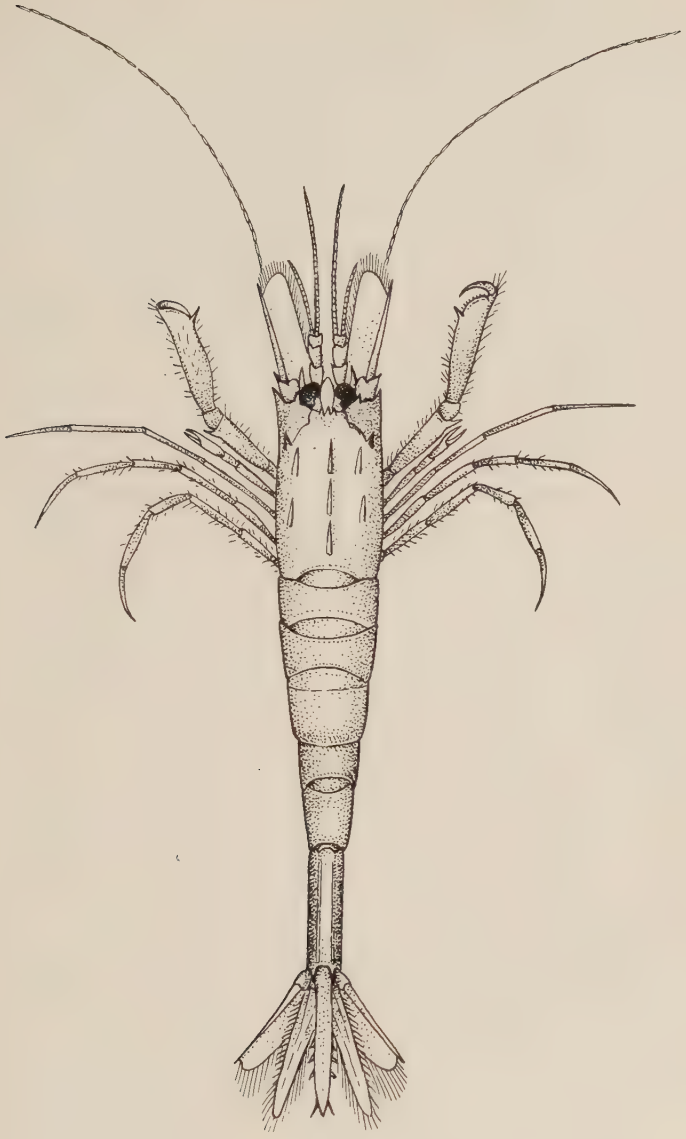
Crangon septemspinosa Say, Journ. Acad. Nat. Sci. Phil., vol. 1, p. 246, 1818.—Rathbun, Harriman Alaska Exped., vol. 10, Crustacea, p. 116; Report Canadian Arctic Exped., 1913-18, vol. 7, Crustacea, part A, p. 6A, 1919.

Genus: **PONTOPHILUS** Leach.

Pontophilus norvegicus (M. Sars).

Plate 69.

Type: Collected along the entire coasts of Norway, in the fjords from Christiania Fjord to Varanger Fjord.



Pontophilus norvegicus (M. Sars), × 1.5.

DISTRIBUTION: Subarctic, usually in depths ranging from 200 to 500 fathoms and down to 672 fathoms; more rarely found from 30 to 60 fathoms. Found on the European coast in the westerly part of the Murman Sea, the Scandinavian coast, the Bay of Gascony in 425 to 638 fathoms; off Iceland, in the Davis Straits, and on the American coast as far southward as Cape Cod, Mass., in 94 to 524 fms.

MATERIAL EXAMINED: One specimen dredged in 200 fms., 9 miles S. W. by W. of Port Basque, Newfoundland, by the *"Ara,"* William K. Vanderbilt, commanding.

TECHNICAL DESCRIPTION: Carapace 13 mm. long, including the rostrum; abdomen 40 mm. long. Rostrum small, flat, tongue-like, above and extending as far forward as the eye, with triangulate tip and one small tooth on each side at the base. Carapace with a median dorsal carina composed of three, acute, subequally spaced teeth, each of which is continued posteriorly for a short distance as a carina. There is a short, triangulate, orbital spine and behind it, in line with the first median dorsal gastric spine, is another spine which is continued posteriorly as a carina, and behind this, approximately in line with the second median spine is another similar spine. The hepatic spine is in line with the first dorsal and first lateral spine and has a slight carina posteriorly. There is a sharp antennal spine in advance of and slightly below the hepatic spine. The abdomen tapers posteriorly, the first to fifth segments, inclusive, have the epimeral margin scarcely at all produced and broadly rounded. The sixth segment is about one and one-half times as long as the fifth, with paired, submedian longitudinal carinae, slightly below each of which the posterior margin is produced into a triangulate tooth which projects over the telson. The telson is a little longer than the sixth segment, narrowed to a triangular point; there are three pairs of spines along the proximal half of the lateral margin and a pair of larger subdistal spines, one on each side of the apical tooth. The caudal fan has a short base and a long, slender, narrowly tapering inner blade with the distal margin rounded and a much wider and shorter outer blade, which has the outer lateral margin thickened and terminating in a subdistal tooth, with the distal margin widely, shallowly rounded; both blades have the margin crenulated and ciliated.

The eye is set on a short stalk with a calcareous projection on the dorsal surface; the cornea is spherical, terminal.

The antennulae have the basal joint excavate beneath the eye, with the outer lateral margin lobate-acuminate and separated from the dis-

tal under portion by an incision; the second and third joints successively shorter, subcylindrical, the inner whip the longer, extending nearly a quarter of an inch beyond the scaphocerite; the outer whip extends only a couple of joints beyond the scaphocerite.

The antennae have a short proximal article with a small tooth at the outer distal angle; the scaphocerite has the lateral margins subparallel for the greater part of their length, the outer margin decidedly thickened and terminating in a very sharp tooth; the distal margin rounded and ciliated. The second article is short; the third article is elongated, extending three-fifths the length of the scaphocerite; the flagellum is about half as long as the body.

The first legs are subchelate, equal; the merus is narrowed proximally, thickened distally, with an acute spine on the upper distal dorsal margin; the carpus is small, with a spine on the outer ventral distal margin; the propodus is subcylindrical, dorsoventrally flattened, this increasing distally, the inner distal angle produced into an outward, flared, acute spine, the dactyl arising from the outer dorsal angle, the margin between thin and convex, the curved acuminate finger closing upon it.

The second leg is very weak, subchelate.

The third legs are exceedingly frail, long and slender, monodactyl.

The fourth and fifth legs are about as long as the third pair but are less slender and have more cilia.

SYNONYMY.—*Crangon norvegicus* M. SARS, Nyt. Mag. f. Naturg, B. II, p. 248, 1861.

Pontophilus norvegicus M. SARS, *ibid,* B. i5, p. 242, tab. I, figs. 1-25, tab. II, figs. 17-37, 1868.—HANSEN, Danish Ingolf Exped. III, pt. 2, p. 53, 1908 (and references to major synonymy of European records).

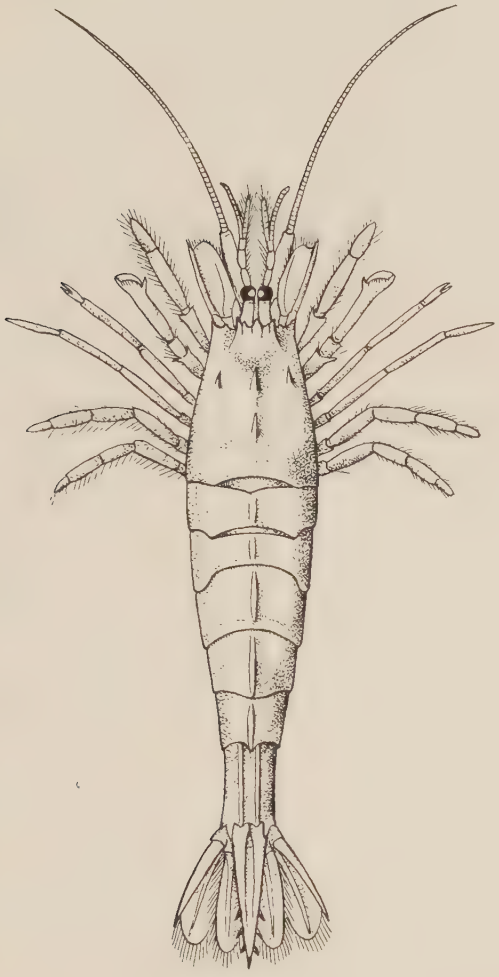
Genus: **ARGIS** Kröyer.

Argis lar (Owen).

Plate 70.

TYPE: "Deposited in the Royal College of Surgeons and Zoölogical Society" (London). "Collected during a voyage to the Pacific and Behring's Strait in H. M. S. '*Blossom,*' 1825-29."

DISTRIBUTION: Known from the Arctic coast of Siberia south to the Kurile Islands; from the Arctic coast of Alaska southward to Sitka; from the Okhotsk Sea southward to Robben Island (off Cape Patience) and Iturup Island; the east, southern and west coast of



Argis lar (Owen), ×1.5.

Greenland; shore line to 120 fms.; described by several authors as being very rare.

MATERIAL EXAMINED: Seven specimens, one of which is ovigerous, taken in 7 fms., upper end of Whitehaven Harbor, Nova Scotia, Sept. 6, 1926.

Three specimens taken in Beaver Harbor, Nova Scotia, September 10, 1926, by the *"Ara."*

TECHNICAL DESCRIPTION: Carapace short, laterally compressed, widening posteriorly, narrowed anteriorly, the eyes and the frontal region between the antennal spines is produced and directed upward. The rostrum is represented by a short, acute tooth, which is carinated in the median line; the frontal margin on either side of this rostrum is concave; the angle above the orbital fissure is nearly right-angled; the fissure is straight, closed; the lower orbital angle is produced in advance of the upper, has an acute apex, with the lower lateral margin convex and densely ciliate; the outer frontal margin is moderately concave, and the pterygostomian angle is armed with a single acute spine; the lateral margin is bent under the body and is slightly convex posteriorly. There is an interrupted carina in the median dorsal line, consisting of three acute, forward-directed spines, the first of which serves as the rostral spine; the second spine has its apex at the mesogastric region; the third spine, which is subequal to the second, has its apex at the anterior cardiac region; each spine runs back a distance as a carina, the hinder one extending to the posterior margin; the hepatic spine is well-developed, acuminate, almost in line with the second spine of the dorsal line. The dorsal surface of the carapace is finely granulose.

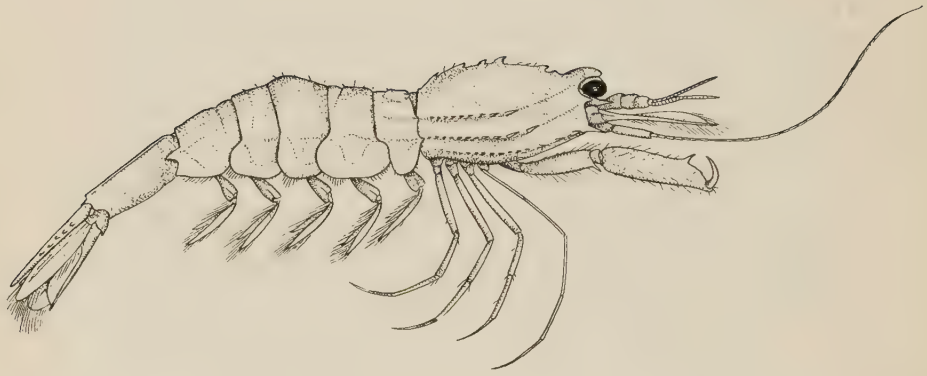
The first abdominal segment is 4 mm. long, with the anterolateral angle rounded; the postlateral angle less so, nearly right-angled, overlapped slightly by the pleura of the second segment, which is of equal length in the median line, with the pleura convex anteriorly and posteriorly, overlapping the adjacent segments, much less convex on the distal margin; the third segment is slightly longer, being 4.6 mm. long, with the posterior margin very slightly concave; the pleural margin nearly straight, the hinder angle being slightly rounded; the fourth segment is 4.5 mm. long, with the median posterior region produced and slightly convex, the hinder margin curving into the deep notch in the median lateral line, beyond which the pleural margin curves outward, forming a slightly convex lobe, the lateral margin is relatively straight. The fifth abdominal segment is 5 mm. long, including

the spine which terminates the dorsal carina; the hinder margin is incised similar to that of the preceding segment, but the lateral margin of the pleura is more convex, the postlateral angle acute. There is a median longitudinal carina extending the length of the first to fifth segments, inclusive, but which is weak on the first and second segments, but increases in strength successively on the third, fourth and fifth segments, terminating on the posterior margin of the latter in an acute tooth. On the sixth segment this carina is replaced by a pair of submedian carinae, each of which terminate in a short spine and which are separated throughout their entire length by a concave groove; the posterior margin is produced into an acuminate, triangular process on either side at the outer base of the telson and the lower postlateral angle of the segment bears an acute tooth. The telson is narrow, tapering to an acute point, a median longitudinal groove throughout its length; three pairs of articulated spines on the distal lateral margin; one pair subdistal to the apex of telson; the second pair halfway between the first and third pairs, which latter is about one-third the length of telson from the apex. The uropoda are about as long as the telson, the inner blade slightly narrower than the outer, with a pronounced median rib; the distal margin narrowed, rounded ciliate; the outer blade has a blunt, subdistal tooth at the terminus of the lateral margin, the distal margin is more widely rounded than that of the inner blade and is ciliated; there is an oblique rib running from the base to the tooth on the outer lateral margin, also a median rib which is separated from the outer one by a groove.

The eyes are set close together on substantial cylindrical stalks, directed upward; the cornea terminal, spherical, a small, rounded projection of the stalk on the inner distal margin.

The antennulae have the basal article greatly elongated, extending beyond the eyes; the inner part cylindrical but flattened beneath the eyes and with a heart-shaped process on the outer side, bent up, forming a lateral shield for the eye; the second and third joints are successively shorter and smaller than the first; the flagella are slightly unequal, the smaller one consisting of 13 rings and the larger, 18 rings; the inner whip with a thick brush of cilia along its lower outer side.

The antennae have the proximal joint small, a tooth at the upper distal angle; the scaphocerite is large, the outer margin nearly straight, terminating in an acute tooth, which extends slightly farther than does the rounded margin of the inner distal portion. The inner margin of the scaphocerite is convex, the widest point being situated



Sabinea septemspinosa Sabine, × 1.3.

about one-third of the length from the base; both inner and distal margins are ciliated. The second article is short, slender; the third elongated, cylindrical, slender, reaching quite to the tip of the scaphocerite; the flagellum is composed of about 100 annulations and measures 23 mm. long.

The external maxillipeds are slightly longer and more prominent than the first chelipeds; the distal article being oblong, flattened, tapering distally and fringed with many cilia.

The first chelipeds are slender; the ischium terminating in a prominent triangulate process on the under side; the merus is very slender, arched or bowed around the mouth aperture; the carpus is very short, rounded; the propodus is a little longer than the merus, cylindrical, dorsoventrally flattened, especially at the distal end, from the outer angle of which the hinged, curved, acuminate dactyl arises and folds across the distal propodal margin, which is convex in the median part and has a strong forward and outward-pointing tooth at the inner angle.

The second legs are very slender, weakly chelate.

The third legs are also very slender, a trifle longer than the second pair, monodactyl.

The fourth and fifth pairs of legs are subequal, shorter and stouter than the third pair and fringed with cilia along their lateral margins.

SYNONYMY.—*Crangon lar* OWEN, in Capt. F. W. Beechey's Narrative of a Voyage to the Pacific and Bering's Strait: to coöperate with the Polar Expedition, performed in H. M. S. *'Blossom,'* Crustacea, p. 88, pl. 28, fig. 1, 1839.

Argis lar KRÖYER, Naturh. Tidssk., vol. 4, p. 255, pl. 5, figs. 45-62, 1842.—DEMAN, Siboga Exped. Monographie 39a/3, p. 256, Jan., 1920, Leyden.

Nectocrangon lar STIMPSON, Proc. Acad. Nat. Sci. Phila., 1860, p. 25. —ORTMANN, *idem,* vol. 47, 1895, pp. 175 and 181.—RATHBUN, Rept. Harriman

Genus: **SABINEA** Owen, 1835.

Sabinea septemspinosa (Sabine).

Plate 71.

TYPE: Sabine's type material consisted of several specimens taken in the trawl on the west coast of Davis Strait.

COLOR: "Varied red and white above, white beneath."

DISTRIBUTION: A polar species, known in Arctic America, eastward from the Alaskan boundary to western Greenland, thence southward on

the Canadian, Labrador, Nova Scotian and New England coasts, as far south as Cape Cod; also from eastern Greenland, Iceland, the Faeroes, from northern Europe southward to Saltenfjord, Norway; from northern Siberia eastward to Long. 170° 17′ East; from the tide line to a depth of 246 fathoms.

MATERIAL EXAMINED: Several specimens, dredged in 40 fms., middle of St. George's Bay, Newfoundland, Sept. 2, 1926.

TECHNICAL DESCRIPTION: Animal 54 mm. long; carapace, including rostrum, 14.5 mm. long in the median dorsal line; abdomen about 40.5 mm. long. The rostrum is short, tongue-like, not reaching beyond the eyes, two-fifths as wide dorsally as long, the distal end rounded broadly, almost subtriangulate, the margins slightly carinate, a slight median carina also; the postorbital angle is a blunt, short, triangular tooth; there is a more prominent spine at the antennal angle reaching almost as far forward as does the basal article of the antennae. The carapace is short, wide and convex, with a median dorsal carina represented by a gastric spine and behind it a crest composed usually of four sharp spines arising from a continuous ridge. A pair of submedian carinae occur on the first abdominal segment. On either side of the median crest of the carapace there are three lateral carinae, the uppermost one arising midway the orbital margin and extending to the posterior margin of the carapace, consisting of ten or twelve spines in line; this carina is continued on the first abdominal segment; the median lateral carina is similarly comprised of a series of spines arising at the postorbital angle and continuing to the posterior margin of the carapace. On the first abdominal segment this carina is continued as a ridge, terminating anteriorly in a sharp tooth, and is more weakly indicated on the second and third segments. The lower lateral carina arises in a sharp tooth at the antennal angle and extends to within a short distance of the posterior margin of the carapace. The extreme lateral margin of the carapace is slightly carinate but not dentate. The first abdominal segment is short, with the three above-described lateral carinae; the lateral margin convex and with a slight depression on the outer surface. The second segment is longer than the first segment and has its epimeral plate expanded, subcircular, overlapping both adjacent segments. The third segment is one and two-thirds times as long in the median line as the second and has the lateral margin rounded; the fourth segment is three-fourths as long as the third and has the postlateral margin very convex. There is a median dorsal carina on the third and fourth segments. The fifth

segment is as long as the third, with the posterior margin straight in the median region, the postlateral angle produced into a triangular process that projects over the sixth segment and with two carinae forming a V, with the apex directed forward, on the dorsal surface and below this a parallel oblique carina. The sixth segment is nearly one-third longer than the fifth, slender, quadrate, a pair of parallel, longitudinal submedian carinae slightly below, which on either side the posterior margin is produced to a projecting triangulate tooth; the telson is slightly longer than the sixth segment, almost as long as the inner blade of the caudal fan, the tip rounded, a longitudinal carina on each side for the proximal two-thirds of the length and armed with five spinules on each, equally spaced. The inner blade of the fan is long, narrow, with a ridge parallel and near the inner margin, the outer margin more convex. The outer blade is much wider and slightly longer than the inner, the distal margin broadly convex, the outer lateral margin ridged, terminating in a subdistal tooth; a submedian groove curves distally to this tooth. The margins of the caudal fan are ciliated.

The antennulae have the three basal articles short, stocky, the shorter branch of the flagellum reaching about as far forward as the subdistal tooth on the outer margin of the scaphocerite; the inner, slenderer branch extends a short distance beyond the scaphocerite.

The antennae have a stocky peduncular article, a short, cylindrical second article and a longer, cylindrical third article which reaches to midway the scaphocerite and a flagellum about three-fifths as long as the animal's body. The scaphocerite is about three-fifths as long as the carapace, thick; the outer lateral margin ridged and terminating in an acute spine which projects beyond the remainder of the evenly convex, ciliated, distal margin; there is also an approximately median longitudinal carina.

The first leg is short, not reaching beyond the scaphocerite, when extended; the merus elongate, somewhat wider distally; the carpus short, nearly as wide as long; the propodus the longest article, subcylindrical, dorsoventrally compressed; the inner lateral margin terminating subdistally in a spine-like tooth, the distal margin evenly convex; the dactyl is a short, acuminate, curved finger fitting upon the propodal margin.

Synonymy.—*Crangon septemspinosa* Sabine, Suppl. to Appendix to Parry's First Voyage for the Discovery of a Northwest Passage, p. 236, pl. 22, figs. 11–13, 1824.—Ross, Appendix to Parry's

Polar Voyage, p. 203, 1824.—H. Milne Edwards, Hist. Nat. Crust., vol. 2, p. 343, 1837.

Sabinea septemcarinata Owen, Appendix to Ross's Narrative of a Second Voyage in Search of a Northwest Passage, p. 82, 1835.—Sars, Forhandl. Vidensk. Selsk. Christ., p. 125, 1858 (1859).—Stimpson, Proc. Acad. Nat. Sci. Phila., 1860, p. 94.—Sidney I. Smith, Trans. Conn. Acad. Arts and Sci., vol. 5, pt. 1, p. 57, pl. 11, fig. 5, 1879.—Spence Bate, Rept. Voy. *"Challenger,"* Zoöl., vol. 24, p. 493, pl. 89, fig. 9, pl. 90, fig. 1, 1888.—Whiteaves, Catal. Marine Invert. Eastern Canada, publ. by Geol. Surv. Canada, 1901, p. 254.—Hansen, Danish Ingolf Exped., vol. 3, pt. 2, p. 52, 1908.—Rathbun, Report Canadian Arctic Exped., 1913-18, vol. 7, Crustacea, part A, p. 7A, 1919.

SCHIZOPODA.

Order: MYSIDACEA.

Family: LOPHOPGASTRIDAE.

Genus: **GNATHOPHAUSIA** Willemoes Suhm.

Gnathophausia willemoesia G. S. Sars.

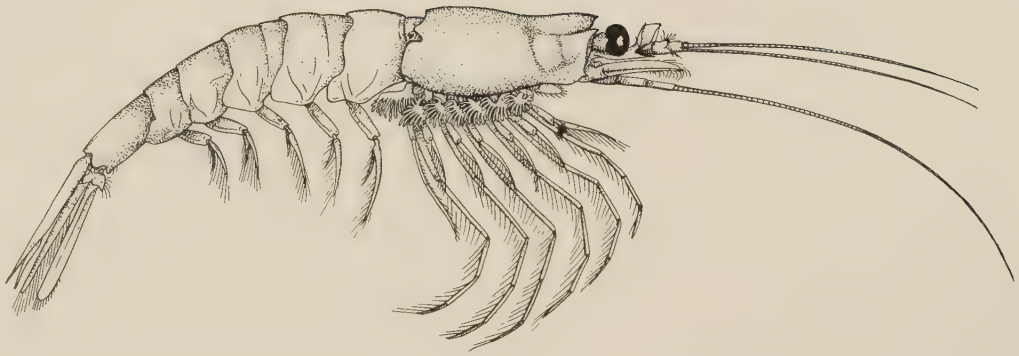
Type: Two specimens, taken by the *"Challenger,"* south of Amboina, Lat. 4° 21′ S., Long. 129° 7′ E., in 1425 fms., and deposited in the British Museum.

Distribution: Known from seven specimens; the type and four taken in the American Tropical Pacific by the *"Albatross"* and the *"Ara"* specimen, in depths ranging from 493 to 1425 fms.

Material examined: One specimen, dredge down 300 fms., bottom depth 1400 fms., 7 miles S. W. of Cape Malo, Panama, Pacific Ocean, March, 1926.

Color: Spectrum red. (See Faxon's beautiful color plate.)

Discussion: This truly gigantic Schizopod which attains a body length of three to four inches, is easily recognized by its very long, sword-like rostrum which is fully four-fifths as long as the carapace and is armed with a row of fine denticles on each side. It is spectrum red. The *"Ara"* specimen is one of the largest yet captured. The carapace covers the entire trunk, the dorsal spine is acute, relatively short, extending a little beyond the first abdominal segment. The supraorbital spines are very strong, acute, anteriorly curved; the antennal spines are acute; the branchiostegal spines are obsolete. The



Meganyctiphanes norvegica (M. Sars), ×3.

first five abdominal segments are carinated and are each produced posteriorly into a short dorsal process. The telson is linguiform with the lateral margins evenly curved, the end densely spinose; the apical spines are rather short, with their posterior margins serrate. The uropoda are shorter than the telson. The eyes are pyriform. The scaphocerite is about twice as long as wide, with the distal end of the blade rounded and only protruding a little beyond the distal spine of the outer lateral margin.

SYNONYMY.—*Gnathophausia willemoesia* G. O. SARS, Forhandl. Vidensk. Selsk. Christiania, No. 7, p. 6, 1883; Rept. Voy. "*Challenger,*" Zoöl., Schizopoda, vol. 13, p. 38, pl. V, figs. 1-6, 1885.—FAXON, Mem. Mus. Comp. Zoöl., vol. 18, p. 215, color plate K, fig. 1, 1895.

Genus: **MEGANYCTIPHANES** Holt and Tattersall.

Meganyctiphanes norvegica (M. Sars).

Plate 72.

TYPE: Sars' type was taken in the Christiana Fjord, Norway, and deposited in the museum.

MATERIAL EXAMINED: Six specimens dredged 9 miles S. W. of Port Basque, Newfoundland, 200 fms., September, 1926, by the "*Ara.*"

RANGE: The North Atlantic Ocean, including the coasts of North America and Northern Europe; surface to bathypelagic.

TECHNICAL DESCRIPTION: Animal slender, abdominal segments much compressed; the carapace with the cervical groove sharply defined, separating the median anterior third of the carapace from the hinder part and bifurcating on the anterior lateral region, as indicated in the figure. The rostral carina extends as far posteriorly as the cervical groove and terminates anteriorly in a slight median point; viewed dorsally, the frontal margin has a slight median point which is rounded on either side and runs a little backward to unite with the slightly ridged, elevated triangular peak which forms the orbital spine and which is acuminate distally. There is a very small spine at the base of the antennae. The posterior half of the lateral margin is somewhat produced and rounded. The posterior margin is concave in the median region, then produced on the upper lateral portion into a rounded process which is separated by a slightly narrower rounded sinus from the wider convex lobe of the postlateral margin. The abdominal segments have the proportions and contour shown in the figure; the telson is very long, slender and acuminate, the dorsal surface flattened and

lightly channelled, the apex very acute. There are a pair of articulated, subdistal, slender, acute spines, about one-third as long as the telson and placed one on each side of it.

The eye is large, very short-stalked, nearly spherical, the distal half being slightly the larger and occupied by the cornea.

The antennulae have the basal segment elongate, dorsally flattened and slightly concave, with the outer lateral margin fringed with a row of stiff setae, and with a large, leaf-like process at the distal margin; the second article is about half as long as the first and the third article is two-thirds as long as the second; both are rather stocky; the flagella are nearly equal in length, each being nearly half as long as the body.

The antennae have the basal article short, the scaphocerite as long as the antennular peduncle and with its outer lateral margin straight and terminating in a minute tooth distally; the inner lateral margin convex, the blade narrowed distally and rounded, margin ciliated; the dorsal surface bears a distinct longitudinal keel. The second and third articles lie beneath the scaphocerite and reach almost to its distal margin, being nearly subequal in length; this flagellum is about twenty-five percentum longer than the antennular flagellum.

The series of legs are in ratio to each other as illustrated in the plate 74.

The gills are very acurately drawn.

SYNONYMY.—*Thysanopoda norvegica* M. SARS, Nyt. Mag. Naturvid., Bd. XV. 1868.—VERRILL, Rept. U. S. Comm. Fisheries for 1883, p. 523, 1885.

Nyctiphanes norvegica G. O. SARS, Rept. Voy. *"Challenger,"* Zoöl., Schizopoda, vol. 13, p. 115, 1885.

Meganyctiphanes norvegica HOLT AND TATTERSALL, Rept. Sea and Inland Fisheries of Ireland, 1902-03, pt. 2, No. 4, p. 105, p. 135, pl. 16.—Hansen Danish Ingolf Exped., Crust. Vol. 3, pt. 2, p. 85, 1908.

Family: EUCOPIDAE G. O. Sars.

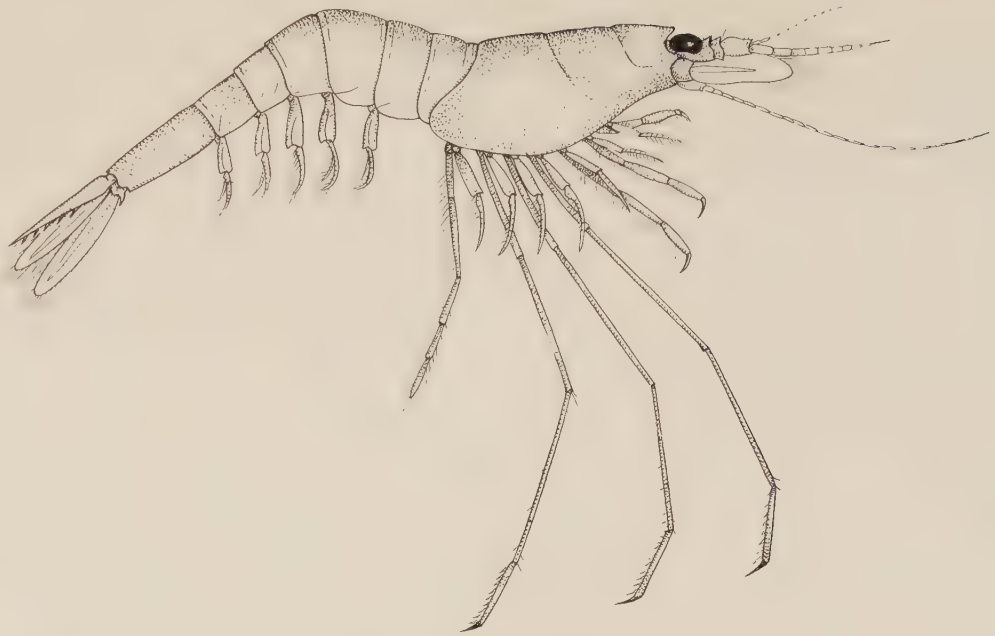
Genus: EUCOPIA Dana.

Eucopia unguiculata Willemoes-Suhm.

Plate 73.

TYPE: Collected by the *"Challenger"* in the Atlantic Ocean and deposited in the British Museum.

DISTRIBUTION: Taken from the surface down to 1000 meters in the North Atlantic, also known from the Mediterranean Sea; found in the Indo-Pacific deep-sea fauna by the *"Siboga"* Expedition.



Eucopia unguiculata Willemoes-Suhm, ×3.3.

MATERIAL EXAMINED: A single dredge-broken specimen, taken when the dredge was down 400 fms., off St. Raphael, bearing S. S. E., distance 9 miles, in the Mediterranean Sea, south of France, March 23, 1927, by the *"Ara,"* William K. Vanderbilt, commanding, establishes what seems to be the first record of this interesting species from the Mediterranean Sea.

COLOR: Spectrum red with light markings of purplish-blue on the tips of the legs and external maxillipeds.

TECHNICAL DESCRIPTION: The *"Ara"* specimen, which is too broken to permit complete description, establishes the seventh record of this species, which has been expertly diagnosed and figured by Dr. Hansen. The following notes should prove of interest because this is apparently the first record of the species from the Mediterranean Sea.

Carapace with the frontal margin rounded on the dorsal surface, concavely excavate on the lateral side above the eyestalk and then produced to a narrowly rounded lobe at the anterolateral angle. The integument of the carapace is soft and smooth, the postlateral lobes are much produced and rounded, convex, overlapping the side of the first abdominal segment. The cervical groove is well defined. The abdomen is convex, smooth, tapering posteriorly, the first three segments are in line with the carapace; the remainder of the abdomen is bent downward. The first, second, third and fifth segments are of about equal length; the fourth being very slightly longer than the third segment; the sixth segment is elongated, two and one-half times the length of the fifth segment. The telson is seven-eighths as long as the sixth segment and is quite narrow, tapering to an extremely narrow, rounded point which is set distally with two articulated, slender, setose spines. The proximal part of the telson has an elongate, low, rounded lobe on each side, separated by the median longitudinal groove or depression which extends the length of the telson and is augmented through the distal four-fifths by a fine line of spinules. The lateral margins of the telson are armed along the distal three-fifths with a continuous row of spinules, some of which are longer than others, all being very long. The uropoda are a trifle longer than the telson; the peduncle is small, its outer distal angle lobed; the inner blade is about one millimeter longer than the telson and is extremely narrow, tapering to a narrowly rounded apex; it has a submedian keel and is fringed with long, plumose cilia. The outer blade is about one millimeter longer than the inner and one and two-thirds times as wide, with the distal angle broadly rounded; the inner

and distal margins ciliated; an approximately median longitudinal groove extends for the proximal five-sixths of the length of the blade.

The eyes are cylindrical, the stalks short and broad, directed outwards; the cornea occupies about one-third of the entire length of the stalk.

SYNONYMY.—*Chalaraspis unguiculata* WILLEMOES-SUHM, Trans. Linn. Soc. London, ser. II, vol. I, pt. 1, pp. 37-40, pl. 8, 1875 (part).

Eucopia australis G. O. SARS, Rept. Voy. *"Challenger,"* Zoöl., vol. 13, p. 55, pls. 9 and 10, 1885.

Eucopia unguiculata H. J. HANSEN, Bull. L'Inst. Oceanog. Monaco, No. 42, p. 3 (42), 1905; Siboga-Exped. Sergestidae, mon. 38, p. 20, pl. 1, fig. 3a, 1910, Leiden.

Family: EUPHAUSIIDAE.

Genus: NEMATOSCELIS G. O. Sars.

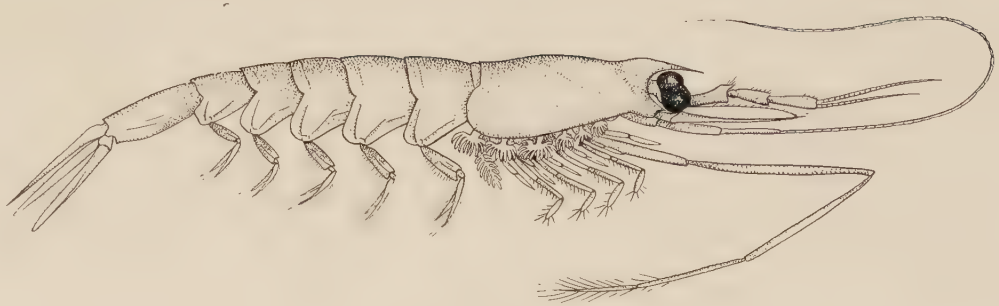
Nematoscelis megalops G. O. Sars.

Plate 74.

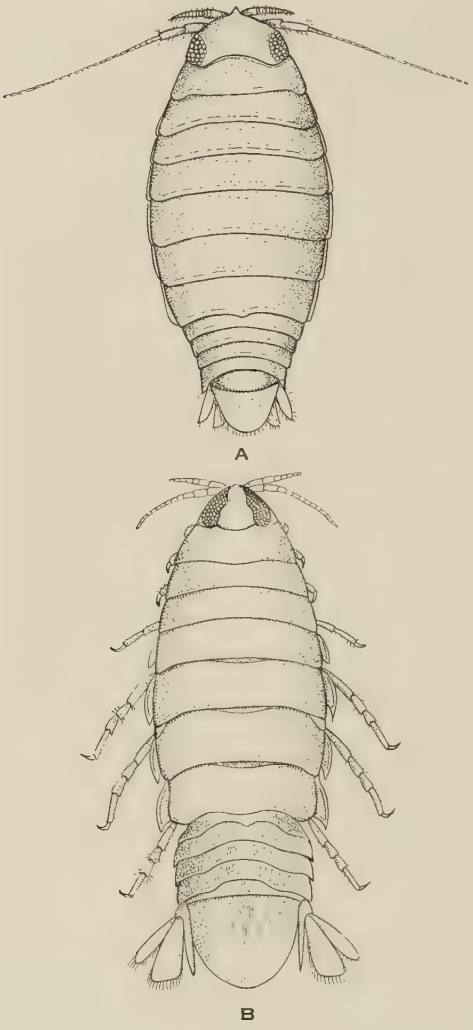
MATERIAL EXAMINED: Twelve specimens, two of which are ovigerous, taken with the dredge down 900 fms., 10 miles S. by E. of Monaco Harbor, Mediterranean Sea, April 19, 1927, by the *"Ara."* One specimen, taken with dredge down 300 fms., 50 miles S. W. of Cape Malo, Panama, March, 1928.

TYPE: This species, which is type of the genus, was founded upon material taken by the *"Challenger"* at stations 332 and 333, in the South Atlantic, in abundance at the surface. The type is deposited in the British Museum.

DISCUSSION: This species has been so repeatedly taken in schools that it seems correct to classify it as a gregarious form. It is found at or near the surface and has also been taken at great depths. This species has been exhaustively described by G. O. Sars in the *"Challenger"* Report. The four outstanding diagnostic characters of *N. megalops* are: (a) The prodigious development of the eyes, which are irregularly globose with the cornea sharply contracted in the median region. (b) The unusually narrow and curved rostrum. (c) The slender form of the antennal scale. (d) The extraordinary length of the first pair of legs, which are unusually elongate, attaining, when fully extended, the whole length of the body; the merus reaching far beyond the distal end of the antennular peduncle, the propodal joint a little sharper than the carpal, the dactyl very minute.



Nematoscelis megalops G. O. Sars, ×4.



A.—*Cirolana mayana* Ives, × 6.6. B.—*Rocinela aries* Schiodte and Meinert, × 3.3.

SYNONYMY.—*Nematoscelis megalops* G. O. SARS, Forhandl. Vidensk. Selsk. Christiania, No. 7, p. 27, 1883; Report "*Challenger*," Schizopoda, vol. 13, p. 127, pl. 23, figs. 5-10, pl. 24, 1885.

ISOPODA.

Family: CIROLANIDAE.

Genus: CIROLANA Leach.

Cirolana mayana Ives.

Plate 75, fig. A.

TYPE: The species was founded on three specimens from the Port of Silam and deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: Coast of Yucatan, Santa Marta, Colombia; Boqueron Bay and Culebra, Porto Rico; Brandon's, Barbados; San Francisco Bay, California.

MATERIAL EXAMINED: 34 specimens, some of which are ovigerous, taken at Hawk's Nest, Cat Island, Bahamas, cruise of 1928.

TECHNICAL DESCRIPTION: Animal small, 3 mm. long, maximum diameter, very convex transversely.

HEAD: Three-fourths as long as wide, with the anterolateral margin broadly rounded; eyes large, round, compound, slightly convex, lateral, shining black. Inner antennae short, tapering, reaching to the anterior margin of the first thoracic segment. External antennae extending to the posterior angle of the fifth thoracic segment, very slender. The external maxilliped is composed of seven articles. The mandible has a palp of three articles.

THORAX: The first six segments are subequal in length and similar, except that the first segment has the lateral parts slightly the wider; the seventh segment is similar to but not quite as long as the sixth segment; the second to seventh segments, inclusive, have the epimeral plate sharply defined, the first four epimera being approximately right-angled posteriorly, while the last two have the postlateral angle produced, acute.

The first three pairs of legs are short and have the dactyli very acuminate, hook-like; the related propodi are stocky set with spinules on the inferior margin; the fourth to seventh legs are increasingly longer, ambulatory, the dactyl acuminate but less curved; the four distal joints set with spinules.

Abdomen: The first segment is short, mostly concealed; the second to fifth segments, inclusive, are subequal, each with the postlateral angle acute; the telson is about as long as the four preceding segments considered together, and has the postlateral margin broadly rounded. The uropoda have the peduncles small, the blades unequal, the outer blade only two-thirds as long as the inner, suboval, widest distally and also heavily ciliated.

There are five pairs of pleopoda, lying one upon the other, each biramose with a stout peduncle; the two blades are elongate-oval, heavily ciliated distally.

Synonymy.—*Cirolana mayana* Ives, Proc. Acad. Nat. Sci. Phila., pp. 186-187, 1891, pl. 6, figs. 3-1o, 1891.—Richardson, Proc. U. S. Nat. Mus., vol. 23, p. 512, 1901.—Moore, Bull. U. S. Fish. Comm., vol. 20, part 2, p. 166, pl. 8, figs. 1-5, 1901.—Richardson, Bull. 54, U. S. Nat. Mus., p. 87, figs. 66-69, 1905.—Boone, State Univ. Iowa, Studies Nat. Hist., vol. 9, No. 5, 92, 1921.

Family: AEGIDAE.

Genus: ROCINELA Leach.

Rocinela aries Schiodte and Meinert.

Plate 75, fig. B.

Type: Collected in Panama Bay and deposited in the Copenhagen Museum.

Distribution: Gulf of Lower California, Mazatlan, Mexico, and Panama Bay.

Material examined: One specimen parasitic on snapper, Jicaron Island, Panama, Pacific Ocean, Jan. 27, 1928, by the *"Ara."*

Technical description: Animal elongate-ovate, 17 mm. long; 7 mm. greatest width.

Head: Triangular, scarcely at all inserted; three millimeters wide proximally, one and one-half millimeters long, with the apex rounded and produced over the basal antennal articles. The eyes are large, elongated, laterodorsal, with the anterior ends narrower, converging but not meeting, separated posteriorly by a distance equal to the length of one eye and separated anteriorly by about the average width of the eye. Inner antennae with first article short, concealed beneath the head in a dorsal view; second article twice the length of the first; third article one and one-half times as long as the second; flagellum composed of five small articles. Outer antennae more robust, extending to the anterior margin of the first thoracic segment; the first ar-

ticle short, but twice as long as the inconspicuous second article; the third article about twice as long as the first; the fourth article a trifle longer than the third article; the fifth article about one and one-half times as long as the fourth; the flagellum is composed of twelve articles. The frontal lamina is inconspicuous, ventrally placed, triangular. The maxilliped has a palp of two articles.

THORAX: The first article is not quite as long as the head; the second and third segments, which are subequal, are each slightly shorter than the first segment; the fourth segment is about as long as the first; the fifth and sixth segments are subequal, each slightly longer than the fourth; the seventh segment is not quite as long as the sixth. Epimera are distinct on all seven segments; they are narrow plates with the posterior angles increasingly acute, that of the seventh segment projecting beyond its segment.

ABDOMEN: The first segment is short, partially concealed, with its postlateral angle acute; the second, third and fourth segments are longer; approximately subequal; the fifth segment is shorter and with the lateral parts concealed; the sixth or telsonic segment is about as long as the other five considered together and has its posterior margin evenly convex. There is a design etched in black on the base of the telson, composed of three radiating longitudinal lines, arising from the center of a wide arc, the two ends of which are directed posteriorly. There are also many small black flecks on the epimera. The uropoda have the peduncle produced into an oblique, long, tapering, acuminate process which lies next to the telson but is not quite so long; the inner blade is the larger, narrowed proximally, widening distally, the terminal margin broadly rounded; the blade is the smaller, not so long as the inner, with its lateral margins approximately parallel for the greater part of their length; the distal margin rounded.

LEGS: The first three pairs of legs are very prehensile, each armed on the merus with two spines; on the carpus and propodus each with one spine; the dactyl is very hooked.

The fourth to seventh pairs of legs, inclusive, are ambulatory, long, set with a series of spines and with a small, sharp, moderately curved dactyl.

SYNONYMY.—*Rocinela aries* SCHIODTE and MEINERT, Naturhistorisk Tidsskrift (3), XXI, p. 828, 1899; Ann. and Mag. Nat. Hist. (7), IV, p. 170, 1899.—RICHARDSON, Bull. 54, U. S. Nat. Mus., p. 210, figs. 213-215, 1905.

Genus: **NEROCILA** Leach.

Nerocila bartschi Boone.

Plate 76.

TYPE: Collected in Bahia Honda, Cuba, June 7, 1914, and deposited in the United States National Museum.

REMARKS: The specimen before me enables me to correct an error made in 1918, in following the advices of my colleagues in the United States National Museum and creating a new family for this curious parasite, first reported from East American waters by a single malformed specimen taken at Bahia Honda, Cuba.

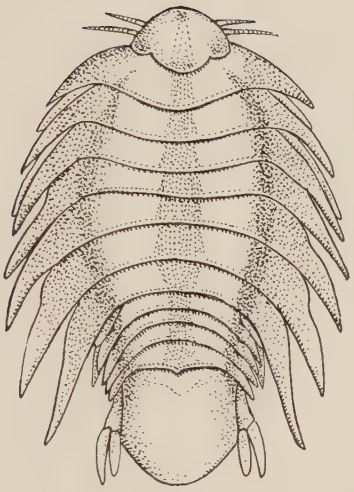
MATERIAL EXAMINED: The specimen taken by the *"Ara,"* at Taboga Island, Perlas Islands, Pacific Ocean, February 19, 1928, establishes the first record for the species from the American Pacific. It is to be regretted that the host of the American specimens is unknown in both cases.

DISTRIBUTION: Known from the coasts of Cuba; also from the Perlas Islands.

TECHNICAL DESCRIPTION: Body strongly depressed, oval, 20 mm. long, 11 mm. wide, or 13 mm. wide, including the wing expansion; thoracic margins produced acutely into roughly triangular, wing-like formations. A broad, median dorsal black band extends the length of the body; followed on either side by a narrower, creamy band, then a broader black band which widens posteriorly extending to the extreme lateral margin from the fifth thoracic segment backward; the lateral margins of the head and first three thoracic segments are tipped with cream color.

Head wider than long, 3.5 mm. 2.5 mm., anterolateral margin oval; median posterior margin oval, less curved postlaterally. Eyes very feeble, located in postlateral angles of the head. The antennae are short and are attached so far on the ventral surface of the head that they are scarcely visible dorsally. The first pair consists of eight short, stout, subequal articles and extend almost to the middle of the first thoracic segment. The antennae are similar but slightly longer, consisting of ten articles. Mandibles small, with a palp of three articles. First maxillae with outer lobe slender, tipped with small spines; inner lobe feeble. Maxilliped with a palp of three articles.

THORAX: First segment 2.5 mm. long, anterior margin excavated, anterolateral angles bluntly produced beyond the angles of the head,



Nerocila bartschii Boone, × about 4.

second, three-fifths as long as the first; third, a little less than second; fourth as long as second; fifth and sixth slightly longer than the fourth; seventh slightly less than sixth. Epimera perfectly coalesced with segments, line of fusion wanting; the lateral parts widely expanded and produced distally into an acute roughly triangular process with the apex directed posteriorly.

Legs: Seven pairs, subequal, strongly prehensile, similar in structure. The first joint strongly produced into a curious wing-like process, which is roughly triangular with acute apex directed outward and posteriorly; this process on the first leg fused with the first thoracic segment, those of second to seventh legs, inclusive, distinct; those of the second and third legs are so produced as to be conspicuous on the dorsal side; the second process equals in length the produced extremity of the second segment; the third process is slightly less than the extremity of the third segment; the fourth to seventh processes, inclusive, are not visible dorsally; the fourth and fifth are stout and not quite as long as the third; the sixth is slenderer and longer than the fifth; the seventh is slender and quite pointed; the second joint of the leg is very small; the third joint is the longest with unique basal curvature adapted to the sculpture of the first joint; the fifth is slightly longer than the fourth; the sixth is a strongly curved claw folding over the fifth, with a tip reaching the basal part of the fifth joint.

Abdomen: This consists of six segments, the first of which is hidden, except the postlateral extremity, by the thorax; the second, third, fourth and fifth segments are subequal, about 1 mm. long; they are decidedly curved posteriorly and overlap each other; the postlateral angles are acutely produced, the sixth segment is shield-shape, wide as long, 6 mm., 6 mm., its length being slightly greater than that of the first five segments; the postlateral margin is evenly rounded. Uropoda 4 mm. long, biramous; peduncle triangular, posterior margin bluntly toothed, with inner postlateral angle acutely produced; the outer branch slender, curved, terminating in a bluntly rounded point; the inner branch is not quite as long, more oval basally, but also bluntly pointed distally. Pleopoda five pairs, natatory, biramous, outer branch much the larger, oval, folding over the smaller but similar inner blade.

Synonymy.—*Pterisopodus bartschi* Boone, Proc. U. S. Nat. Mus., vol. 54, p. 596, pl. 89, figs. 2, 3, 4 and 5, 1918.

Genus: **ANILOCRA** Leach.

Anilocra laticauda H. Milne Edwards

TYPE: The type is recorded as inhabiting the Antillean waters and being deposited in the Paris Museum.

DISTRIBUTION: Known from the Chesapeake Bay, off Maryland, southward to the Straits of Magellan, as a parasite of *Haemulon plumieri* (common grunt or cachicata), of *H. arcuatum,* of *Upeneus martinicus* (yellow goat-fish), of *Chromis marginatus marginatus* (Castelnay), of *Ocyurus chrysurus, Bathystoma rimator* and of *Abudefduf saxtalis.*

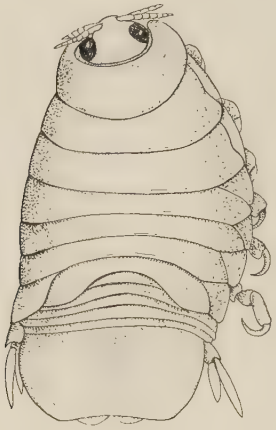
MATERIAL EXAMINED: One specimen taken at Bury Island, Bahamas, January 21, 1923; one large ovigerous female taken in dredge at 11 fms., Casa Blanca, Cuba, August 22, 1924; 11 representatives of young, free-swimming stages, Hogsty Key, British West Indies, February 13, 1926, by the *"Ara."*

TECHNICAL DESCRIPTION: Body asymmetrical, thoracic region very convex, transverselt, caudal fan rounded.

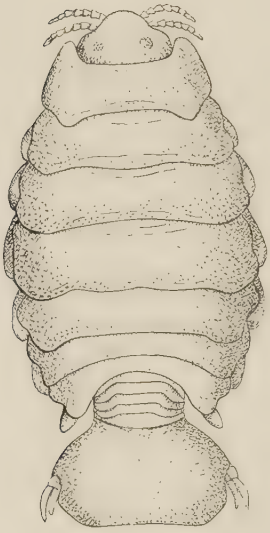
HEAD: Triangular, anterolateral margins rounded, interorbital space nearly twice as wide as the long diameter of the orbit; eye small, elliptical, postlateral in position, scarcely at all elevated above the surface of the head; posterior margin of head slightly sinuate. External antennae composed of nine stocky, tapering articles and reaching to midway the margin of the second thoracic segment. The inner antennae consist of seven articles, are about half as long as the outer antennae.

THORAX: The first thoracic segment is as long as the head and has the anterolateral angles produced and closely appressed to the head; the second segment is half as long as the first segment; the third segment is three-fifths as long as the first and the fourth segment is equally as long as the first; the fifth segment is subequal to the fourth; the sixth segment is one and one-third times the fifth; the seventh segment is about as long as the fifth. The first, second and third thoracic segments have their epimera rather broadly rounded; those of the fourth, fifth and sixth and seventh segments are rather more elongated and acuminate posteriorly, the last one being quite acute.

ABDOMEN: The first segment is partly concealed; the second to fifth segments are subequal except that the lateral margins of the second, third and fourth segments are broadly rounded, while that of the fifth segment is obliquely truncated, with the postlateral angle



A



B

A.—*Cymothoa exigua* Schiodte and Meinert, ×3.3. B.—*C. excisa* Perty, ×5.3.

acute. The telson is subcircular, with the proximal border thickened and usually a shallow depression on each side near this border. The peduncle of the uropoda is carinate and thickened on its outer margin; the two lateral margins divergent distally; the distal margin sinuate. The inner blade of the uropoda is slightly longer than the outer; both are long and narrow, the distal margin rounded, the outer lateral margin slightly convex, the inner lateral margin correspondingly concave, and subparallel throughout the greater part of its length to the outer margin.

LEGS: All seven pairs of legs are decidedly prehensile and successively increase slightly in length from the first to seventh pair. Each dactyl is very acuminate and so strongly curved that its tip is approximately in line with the base of the propodus.

MOUTHPARTS: The maxillipeds have a palp of two articles. The palp is composed of three articles. (Fully figured in Dr. Richardson's Monograph.)

SYNONYMY.—*Anilocra laticauda* H. MILNE EDWARDS, Hist. Nat. Hist. Crust., III, p. 259, 1840.—SCHIODTE and MEINERT, Naturorisk Tidskrift (3), vol. 13, p. 126, pl. 9, figs. 1-3, 1881-83.—RICHARDSON, American Naturalist, vol. 34, p. 221, 1900; Proc. U. S. Nat. Mus., vol. 23, p. 528, 1901; Bull. 54, U. S. Nat. Mus., p. 227, figs. 230-231, 1905.—MOORE, Rept. U. S. Fish. Comm., vol. 20, pt. 2, p. 172, pl. 10, figs. 3-4, 1901.—BOONE, Univ. Iowa Studies Nat. Hist., first series, No. 45, p. 94, 1918; Bull Bingham Oceanog. Coll., vol. 1, art. 2, p. 139, 1927.

Anilocra mexicana DE SAUSSURE, Rev. Mag. Zoöl., p. 505, 1857.

Anilocra leachii (KRÖYER), SCHIODTE, Nat. Tidsk. (3), vol. 13, p. 205, pl. 11, fig. 2a-2g, 1866.

Family: **CYMOTHOIDAE.**

Genus: **CYMOTHOA** Fabricius.

Cymothoa exigua Schiodte and Meinert.

Plate 77, fig. A.

TYPE: Taken at Panama and Charles Island, Galapagos, in the mouth of *Citharichthys sordida,* a small translucent flounder, and deposited in the Copenhagen Museum.

DISTRIBUTION: Known only from the type and the *"Ara"* specimen; also taken in the Galapagos, host, an angel fish.

MATERIAL EXAMINED: One specimen taken as parasite in the mouth

of an angel fish, James Bay, San Sebastian Island, Galapagos Islands, March 3, 1926.

Technical description: Head deeply inserted, the apex of the anterolateral angle reaching slightly farther forward than the anterior angle of the eye; head with the anterolateral margins rounded, median rostral point prominent; posterior margin relatively straight; length in the median line equal to seven-eighths of the greatest width; eyes median lateral, subovate, black. Inner antennae, consisting of six articles, stockier than the outer antennae, extending back as far as midway the eye. External antennae, consisting of seven articles, extending slightly beyond the first antennae.

Thorax: The first thoracic segment is 2 mm. long in the median line, or 0.5 mm. shorter than the head, and has the anterolateral angles produced and closely applied to the head for a distance equal to half the length of the head, outer margin of angles convex. Second, third and fourth thoracic segments similar and subequal in length, each being two-thirds as long as the first thoracic segment is in the median line; the fifth thoracic segment is similar to but only two-thirds as long as the fourth; the sixth segment is two-thirds as long as the fifth and has the median posterior margin concavely excavate for the reception of the abdomen.

The epimera are nearly as long as the related segments, narrow, with the postlateral angle rounded. The epimera of the fourth segment is not quite as long in proportion to its segment as that of the third segment and is more acuminate posteriorly. There is also a nearly median incision in the lateral margin of the fourth segment and the hinder half of the margin is rounded; the fifth and sixth segments are similarly notched and their lateral margins are even more rounded; the lateral margin of the seventh segment is incised nearer its posterior angle, the hinder lobe being much smaller than the anterior one. The epimera of the fifth, sixth and seventh segments are successively shorter and are rounded posteriorly.

Abdomen: The first abdominal segment is crescentic, much narrower than the others; the second to fifth segments, inclusive, are approximately equal and closely fused with the distal margins bluntly rounded. The telson is wider than long, with the postlateral margin broadly rounded. The uropoda are slender and closely appressed to the telsonic margin; when extended, the blades exceed the length of the telson by almost the distal half of their length. The peduncle is three-fourths as long as the blade and much wider, the inner blade

is slenderer and a trifle longer than the outer; both are curved, tapering distally to an acuminate point, the outer lateral margin slightly convex, proximally, the inner lateral margin correspondingly concave.

LEGS: The seven pairs of legs are similar, strongly prehensile, the posterior four pairs being slightly longer than the anterior three pairs. The first segment is stout, elongate, excavate on the outer postlateral face of the first three pairs of legs and also on the posterior four pairs, but these latter have the anterior lateral face convex and produced into a laminate, convex margin posteriorly. The second segment is scarcely two-thirds the size of the first and is convex, widest distally; the third and fourth joints are very short; the fifth joint is longer, stocky, slightly curved, compressed, convex, its distal articulation heavily reinforced; the sixth or terminal article is as long as the fifth and is very curved, tapering, acuminate, its tip closing down upon the fourth article, hook-like.

SYNONYMY.—*Cymothoa exigua* SCHIODTE and MEINERT, Naturh. Tidsskrift (3), vol. 14, p. 232, 234, pl. 6, figs. 7 and 8, 1883-84.—RICHARDSON, Bull. 54, U. S. Nat. Mus., p. 250, fig. 261 (after Schiodte and Meinert), 1905.

Cymothoa excisa Perty.

Plate 77, fig. B.

TYPE: The type came from Sebastionopol, Brazil, and is deposited either in Munchen or Berne.

DISTRIBUTION: Known to be parasitic on the lip and gill of two fishes, a "Chub" and a species of *Sparus*. Found from Massachusetts southward along the East Coast of the United States, throughout the West Indies and along the northeastern coast of South America, as far down as Rio de Janeiro.

MATERIAL EXAMINED: One specimen from fish, Pilon, Cuba, March, 1928.

TECHNICAL DESCRIPTION: The head is about one-third wider than long, deeply inserted in the first thoracic segment; the prominent, narrowed, acute anterolateral angles of which extend forward about half the length of the head. The median frontal portion of the head curves downward and the anterolateral angles are rounded and curve slightly upward, so that in a dorsal view the frontal margin appears slightly excavate. The eyes are small, indistinct, placed about midway the lateral margin.

The first antennae reach almost to the posterior margin of the head and consist of eight articles. The basal articles of the two first antennae are well separated.

The second antennae consist of nine articles, the distal three of which extend beyond the first antennae.

The palp of the maxilliped has two articles; that of the mandibles has three articles.

The first thoracic segment is about one and one-half times as long as the second. The second, third and fourth segments are subequal; the fifth segment is about half as long as the fourth segment; the sixth segment is subequal to the fifth; the seventh segment is about half as long as the sixth. The epimeral plates are sharply defined on all except the first segments. They are narrowed, elongate plates, those of the second to fourth segments, inclusive, each about two-thirds to three-fourths as long as the related segment, the fifth epimera reaching almost to the postlateral angle of the segment; the sixth and seventh epimera extending quite to the extremity of the postlateral angles.

The abdomen is deeply set in the thorax, the first segment being very narrow, the remaining segments gradually increasing in length; the telson is about twice as wide as long, broadly rounded on the postlateral margin and slightly excavate in the median posterior margin. The uropoda are short, both blades narrow, rounded distally, the inner branch the shorter.

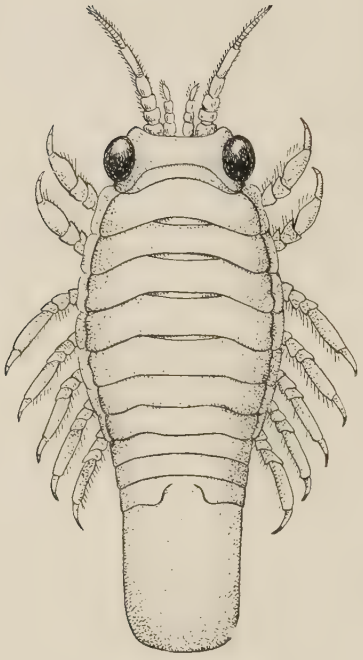
All seven pairs of legs are strongly prehensile, with curved, hook-like dactyli, each of which has a high carina on the basis of the last four pairs of legs; the carina increasing in height from the fourth to seventh legs respectively.

SYNONYMY:—*Cymothoa excisa* PERTY, Del. Anim., p. 31, 1830-34.

Cymothoa parasitica DE SAUSSURE, Revue Mag. Zoöl. (2), IX, p. 306, 1857; Mém. Soc. Phys. Genève, XIV, pt. 2, p. 485, pl. 5, fig. 44, 1858.

Cymothoa excisa SCHIODTE and MEINERT, Naturhistorisk Tidsskrift (3), XIV, 1883-84, p. 238-244, pl. VI, figs. 11-16 (responsible for above synonymy).

RICHARDSON, Amer. Nat., vol. 34, 1900, p. 221; Proc. U. S. Nat. Mus., vol. XXIII, p. 530, 1901; Bull. 54, U. S. Nat. Mus., p. 248, text figs. 259-260, 1905.



Idothea metallica Bosc, ×6.

Family: IDOTHEIDAE.

Genus: IDOTHEA Fabricius.

Idothea metallica Bosc.

Plate 78.

DIAGNOSTIC CHARACTERS: Body oblong-ovate; telsonic segment truncate at its extremity.

TYPE: Described as "an inhabitant of the sea."

DISTRIBUTION: Pelagic and bathypelagic in the North Atlantic, off both American and European coasts; also in the Mediterranean Sea; depths ranging from surface on floating weed to 91 fms. The "*Ara*" specimen was taken when the dredge was 900 fms. down.

MATERIAL EXAMINED: Two specimens taken S. by E. of Monaco, Mediterranean Sea, 900 fms., April 19, 1927, by the "*Ara*," William K. Vanderbilt, commanding.

COLOR: Iridescent blackish-grey, or slaty-steel color.

TECHNICAL DESCRIPTION: Body oblong-ovate, the greatest width across the third thoracic segment, decidedly convex from side to side, narrowing posteriorly.

HEAD: Subrectangular, 1.5 mm. long, 3 mm. wide; anterior margin slightly excavate, anterolateral angles deflected, rounded, a slightly curved, transverse groove across the head not far from the posterior margin; posterior margin slightly excavate. The eyes are large, compound, convex, situated at the anterolateral angles, shining black.

THORAX: The first thoracic segment is about as long as the anterior portion of the head and has its lateral parts expanded, the anterolateral angle rounded and fitting close to the head; the second, third and fourth segments are subequal in length to the first segment and to each other; the fifth, sixth and seventh segments are subequal to each other, each about three-fifths as long as the fourth segment; the second to seventh segments, inclusive, have the epimeral plates articulated; the first and second epimera with the postlateral angle rounded; the remaining epimera with this angle right-angled, or obtuse.

ABDOMEN: This consists of three distinctly separated and one partly fused segment. The first and second segments are slightly shorter than the last thoracic segment and have their lateral angles acute; the third segment is fused in the medina region with the telson, separated laterally, about as long as the preceding segment. The telson is 4.1

mm. long, 3 mm. wide proximally, 2.4 mm. wide distally, convex, with the posterior margin truncated. The uropoda form valve-like doors, covering the pleopoda.

The inner antennae are short, consisting of stocky articles, extending only to about midway the third article of the second antennae.

The outer antennae consist of five peduncular articles and a flagellum of eight articles, each furnished with small setae.

The external maxillipeds have a palp of four articles.

The legs are slender, subsimilar; each has the carpus and propodus moderately thick and armed with numerous spinose bristles on the ventral face; the dactyl is very curved, acuminate, with a horny tip, appearing almost prehensile.

The pleopoda are elongate-oval and heavily ciliated on the margins.

SYNONYMY.—*Idotea metallica* BOSC, Hist. Nat. Crust., vol. 2, p. 179, pl. XV, fig. 6, 1802.—LATREILLE, Hist. Nat. Crust. et Insectes, vol. 6, p. 373, 1803.—MIERS, Journ. Linn. Soc. London, XVI, 1883, pp. 35-38 (with full synonymy).—HANSEN, Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjobenhavn, 1887-1888, p. 188.—DOLLFUS, Feuille des jeunes Naturalistes, 1895, p. 8, fig. 24.—RICHARDSON, Amer. Nat., vol. 34, p. 226, 1900; Proc. U. S. Nat. Mus., vol. 23, 1901, p. 541.—NORMAN, Ann. Mag. Nat. Hist. (7), vol. 14, 1904, p. 443.

Idotea peloponesciaca ROUX, Crust. de la Mediterranee, 1828, pl. 30, figs. 10-12.

Idotea atrata COSTA, Fauna del R. Napoli, Crust., 1838, pl. XI, fig. 3.

Idotea rugosa MILNE EDWARDS, Hist. Nat. Crust., vol. 3, 1840, p. 131.

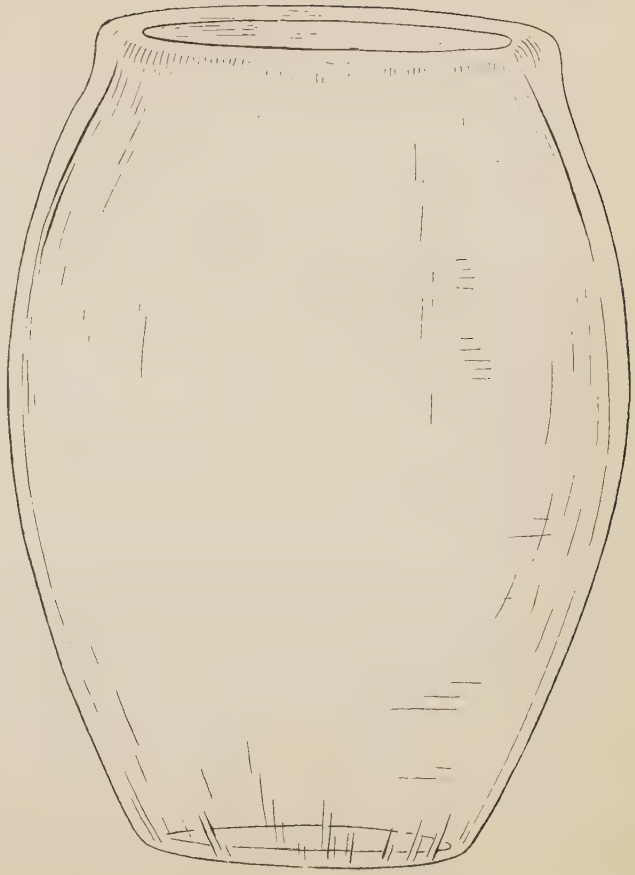
Idotea compacta WHITE, List Crust. Brit. Mus., 1847, p. 95.

Idotea algirica LUCAS, Anim. Arctic in Explor. Sci. Algérie, vol. I, Crust., 1849, p. 61, pl. 6, fig. 2.

Idotea robusta KRÖYER, Naturh. Tidsskr. (2), vol. 2, p. 108, 1846-49; Voy. en Scand., Crust., 1849, pl. 26, fig. 3.—REINHARDT, Naturhistorisk Bidrag til en Beskrivelse af Gronland, 1857, p. 35.—STIMPSON, Proc. Acad. Nat. Sci. Phila., 1863, p. 133.—VERRILL, Amer. Journ. Sci., vol. 2, 1871, p. 360.—HAGER, in VERRILL, Rept. U. S. Comm. Fish and Fisheries, part 1, 1873, p. 439, p. 569, pl. 5, fig. 24.—HARGER, Proc. U. S. Nat. Mus., vol. 2, p. 160, 1879; Report U. S. Comm. Fish and Fisheries, part 6, 1880, p. 349, pl. 6, figs. 30-32.

Idothea metallica RICHARDSON, Bull. 54, U. S. Nat. Mus., p. 362, 1905.

A



B

A.—*Phronime sedentaria* (Förskal), female. B.—The "barrel," made out of a *Salpa* in which this female was housed when taken.

AMPHIPODA.

Family: PHRONIMIDAE.

Genus: **PHRONIME** Latreille.

Phronime sedentaria (Forskal).

Plate 79, figs. A and B.

TYPE: The present depository of Forskal's type is not definitely known.

DISTRIBUTION: Known from the Mediterranean, the temperate and tropical waters of the Atlantic, Pacific and Indian Oceans.

MATERIAL EXAMINED: Two specimens taken in dredge 10 miles south by east of Monaco Harbor, Mediterranean Sea, in 900 fathoms of water, April 19, 1927. One specimen from Marcus Pinedo, Monaco, May, 1925. Three specimens dredged in 325 fms., 38 miles S. E. ½ E. of Cape Spartivento, Sardinia, July 22, 1927. One male and one female, dredged down 300 fms., 50 miles S. W. of Cape Malo, Panama, in the Pacific; bottom depth 1400 fms.

TECHNICAL DESCRIPTION: Animal semitranslucent with muscle bands showing through like silver ribbons; head large; body decidedly attenuated posteriorly.

HEAD: Large, wedge-shaped, widest dorsally, the dorsal surface bilobed, moderately convex, entirely covered by small hexagonal facets through which the reddish-brown oculae show clearly. The frontolateral surface of the head is smooth, rounded, tapering distally; the small, ovate, convex eye placed anterolaterally, consisting of an aggregate of facets similar to those on the dorsal surface of the head.

THORAX: The first thoracic segment is very short; the second segment is twice as long as the first; the third segment is one and one-half times the second; the fourth and fifth segments are subequal, each one and one-half times as long as the third segment; the sixth segment is one and one-half times as long as the fifth, while the seventh thoracic segment is greatly elongated and narrowed posteriorly, two and one-half times as long as the preceding segment and with the postlateral angle triangulate and bent upward, almost at right angles to the body.

ABDOMEN: The first, second and third abdominal segments are much elongated, widening distally, with the lateral margin convex, produced posteriorly and terminating in an acute tooth, that of the first segment rather short, the second tooth longer, and the third tooth very long and acute, with the posterior margin inside it concave and produced to a lesser triangular point near the base of the next segment.

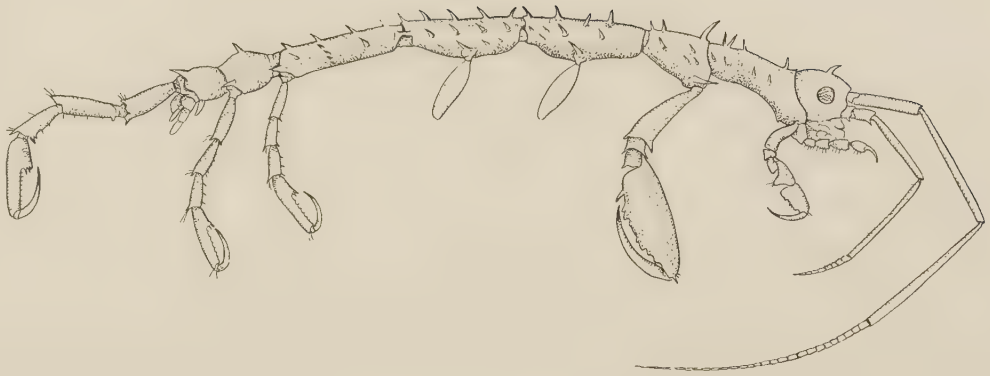
The first abdominal segment is seven-eighths as long as the seventh thoracic segment; the second abdominal segment is three-fourths as long as the first segment; the third abdominal segment is subequal to the second; the fourth abdominal segment is abruptly narrower and only two-thirds as long as the fourth segment, and bears at its external postlateral angles the longest pair of uropoda, which have the slender, divergent pedunculate article rod-like, twice as long as the fifth segment; the inner blade the larger, one-third as long as the peduncle, lanceolate, the tip acute, the outer margin nearly straight, the inner lateral margin very convex; the outer blade is similar to the inner but only two-thirds as long; both have a decided concavity on the upper surface. The sixth segment is not quite half as long as the fifth segment and slightly narrower, and bears at its outer angle the shortest pair of uropoda, which are of similar shape and structure to the largest pair, but are only about two-thirds as long as the first uropoda; the third or medium-size pair of uropoda are about equal in length and similar to the first pair, except that the distal blades are nearly equal; the outer being slightly the longer, as is also the case in the shortest uropoda; the median uropoda arise from the postero-distal angle of the terminal segment.

The first, second and third abdominal segments have the pleopoda well developed, subequal, each with the peduncular article enlarged, forming a broad, suboval side-plate, which is broadest distally and terminates anteriorly in a slight process at the base of the distal article; the distal branch is scarcely two-thirds as long as the peduncle, biramose, the blades being subequal, narrow, tapering to a subacute apex, convex on the anterior surface and marked transversely with twenty or more lines indicating annulation; the lateral and especially the distal margins are heavily fringed with close-set, plumose setae.

Legs: The first and second thoracic legs are weak, the dactyl short, curved, inner margin finely denticulate; there is an ovate, denticulate process arising from the posterior distal angle of the propodus and extending nearly one-third the length of the dactyl.

The third and fourth legs are subequal, slender, much elongated, exceeding the length of the second by slightly more than the length of the dactyl of the third leg. The propodus and dactyl of the third and fourth legs are much elongated, the propodus slender, subequal in length to the dactyl, which is a very curved blade, acuminate-tipped.

The fifth leg is chelate, much enlarged, about as long as the fourth



Caprella geometrica Say, female, × 5.3.

leg. The ischium is greatly elongated, clavate, dilated distally; the merus is quite small, the carpus is about twice as long as the merus, very convex; the propodus has the palm dilated, convex, nearly twice as long as the carpus; the propodal finger is two-thirds as long as the palm, triangulate, curved slightly, acuminate, with a triangular basal tooth; the dactyl or hinged finger is longer than the propodal, slender, very curved, like a scimitar, with a triangular tooth midway the cutting edge; the fingers cross on one another, one-third of the dactyl and nearly half the propodal finger extending beyond the point of crossing.

The sixth and seventh legs are slender, successively shorter; the propodus slender; the dactyl relatively straight and not over two-thirds as long as the related propodus.

The fifth, sixth and seventh legs each have broad, ovate epipodites.

SYNONYMY: *Cancer sedentarius* FÖRSKAL, *P. Decriptiones Animalum, Avium, Amphibiorum, Piscium, Insectorum, Vermium quoe in itinere orientali observavit Petrus* FÖRSKAL. *Hauniae*, p. 95, 1775.

Phronime sedentarius LATREILLE, Hist. Nat. des Crust. et des Insectes (suites a BUFFON), Paris, 1792–1805, vol. 6, p. 291, 1803. (Extensive synonymy).

Phronima custos RISSO, Hist. Nat. Crust. des environs de Nice, Paris, 1816, p. 121, pl. 2, fig. 3.—LUCAS, H., Explorations scientifique de l'Algérie pendant les anneés 1840, 1841, 1842, Zool., p. 57, pl. 5, fig. 5, Hist. Nat. des Animaux articules Paris, 1849.—CLAUS, Zeitschr. fur Wissench Zool., vol. 12, Leipsig, 1862, p. 195, pl. 19, fig. 1, et fig. 4–6.—STEBBING, Rept. Voyage Challenger Amphipoda, vol. 29, p. 1357, pl. 162, B, 1888.—BOVALLIUS, K. Svenska Vet-Akad. Handlinger, vol. 21, no. 5, p. 354, pl. 16, fig. 1–3, 1889. —Stockholm.—CHEVEAUX—Results Campagnes Scientifiques du Monaco, Fasc. 16, p. 136, 1900.

Family: CAPRELLIDAE.

Genus: CAPRELLA Lamarck, 1818.

Caprella geometrica Say.

Plate 80.

NAME: Given because of a fancied similarity in the movements of this Amphipod to those of the larvae of the *Geometridae* (a family of

moths), the larvae of which are popularly known as "measuring worms."

TYPE: "Inhabits salt water bays, common." Say referred to the East Coast of the United States. Deposited in the Academy of Natural Sciences, Philadelphia.

DISTRIBUTION: Known from the East Coast of the United States, from New England to Florida.

MATERIAL EXAMINED: 14 specimens, including both sexes, taken at Eastport, Maine, August 23, 1923.

HABITS: This species lives in the sea-weeds, coralline mats and hydroids, its thread-like body rendering it invisible among the waving fronds. Occasionally a colony of hydroids becomes attached to a living green turtle's shell, and the Caprellas adapt themselves to this sea-going environment, apparently without difficulty, to judge by the countless numbers of specimens in all stages of growth that I have personally picked from the backs of a hundred or more turtles brought into Key West and Miami by the fishermen for shipment to northern markets.

The animal uses its three hinder pairs of legs for clasping around the stem of the seaweed. Although it moves nimbly, looping its body along, after the meaner of "measuring worms," the amphipod will lie quiescent for hours, its body attached to the weed by means of the clasped three sets of hinder legs, the outer part of the body swinging in the tide, like a bit of seaweed, the giant chela occasionally seizing passing prey, not infrequently another Crustacean.

According to Dr. S. I. Smith, these animals possess the power of adapting their own color pattern to that of their environment, being generally grey with darker specks, when living among the hydroids, but often bright red when living among red algae.

TECHNICAL DESCRIPTION: Adult male: Figured, plate 80. Body linear, irregularly subcylindrical, head obtuse anteriorly, with one short, acute spine dorsally, gibbous beneath; the first thoracic segment is longer than the head but somewhat shorter than the three successive segments which are approximately subequal; the last three segments are successively shorter, the terminal one the shortest of the series. The thoracic segments are rounded on the upper surface gibbous on the lower, and ornamented with a series of unevenly placed, conical spines of varying sizes.

The first legs are subchelate, much smaller than the larger second pair, the propodus of which is enlarged, thickened, except along the

hinder lateral margin, which is laminate and cut into three teeth, shaped as in the illustration. The dactyl is very curved, sickle-shaped, acuminate, and closes upon the propodal teeth. The elongate-cylindrical paired gills arise from the third and fourth thoracic segments. The last three pairs of legs are similar in structure but of slightly decreasing length, prehensile; the propodus thickened with one approximately median tooth on the anterior lateral margin; the dactyl about half as long as the propodus, curved, acuminate, its tip closing upon the propodal tooth.

The females are smaller than the males; the spiny ornamentation of the body is less pronounced; the second chelipeds are smaller in proportion to the related body.

SYNONYMY.—*Caprella geometrica* SAY, Journ. Acad. Nat. Sci. Phila., vol. 1, p. 390, 1818.—DEKAY, Zoöl. of N. Y., Crust., part 6, p. 41, 1844 (extra-limital to New York).—WHITE, List Crust. Brit. Mus., p. 357, pl. 56, fig. 8, 1841 (lists specimens donated B. M. by Say—holds the species distinct from *C. acutifrons*).—S. I. SMITH, in VERRILL, Rept. Invert. Vineyard Sound, 1874, pp. 316, 382, 40, 567, pl. 5.—MAYER, PAUL, Arthostraca, in Zoöl. Jahrb. für 1880, pp. 51-63; Mayer says *C. geometrica* equals *C. acutifrons* (Leach Mss.).—LATREILLE, 1816.—UHLER, Chesapeake Zoölogical Laboratory, p. 26, 1878, reports the species at Fort Wool.—KINGSLEY, Standard Nat. Hist., vol. II, Crustacea and Insects, fig. 96, 1884.—R. RATHBUN, Proc. U. S. Nat. Mus., III, p. 1, 1881; records the species at Provincetown, Mass.—STEBBING, Rept. Voy. *"Challenger,"* Zoöl. Amphipoda, vol. 29, pt. I, pt. 2, pp. 104, 207, 224, 437, 485, 554, 1636.

Family: PODOCERIDAE.

Genus: ERICHTONIUS H. Milne Edwards.

Erichtonius rubricornis Stimpson.

TYPE: Collected in Grand Manaan and believed to be no longer extant.

DISTRIBUTION: Abundant in the Bay of Fundy and northward in to the coast of Labrador; less abundant south of Cape Cod, Mass. Littoral to 100 fms., possibly found at greater depths.

HABITS: According to Holmes this amphipod "lives in flexible tubes composed of sand or mud stuck together with a small amount of adhesive web-like material."

Color: In life the animal's body is brownish, maculated; with the antennae and antennulae bright red.

Discussion: The single specimen taken by the *"Ara"* agrees well with Stimpson's excellent description and figures.

Synonymy: *Cerapus rubricornis* Stimpson, Marine Invert. of Grand Manaan, p. 46, pl. 3, fig. 33, 1853.—Bate, Catal. Amphip. Crust. British Museum, p. 256, pl. 45, fig. 4, 1862.—Verrill and Smith, Rept. Comm. Fish. and Fisheries, p. 565, pl. 4, fig. 18, 1873.—*Erichtonius rubricornis* S. I. Smith, Trans. Conn. Acad. Arts and Sci., vol. 4, pt. 2, p. 278, 1882.—Holmes, Bull. U. S. Bur. Fish. vol. 24, p. 518, 1904 (issued 1905).—Rathbun, M. J., Occas. Papers Boston Soc. Nat. Hist., vol. VII, p. 73, 1905.—Sumner, *et al.*, Bull. U. S. Bur. Fish., vol. 31, part 2, p. 655, 1911.

CIRRIPEDIA.

Family: **LEPADIDAE** Darwin.

Subfamily: **Lepadinae.**

Genus: **POECILASMA** Darwin.

Subgenus: **Poecilasma** s. s. Pilsbry.

Peocilasma inaequilaterale Pilsbry.

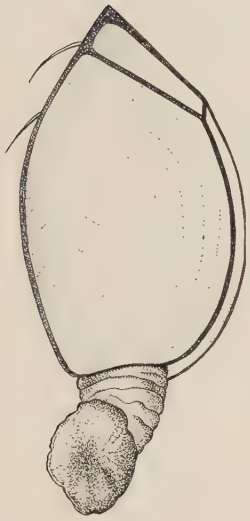
Plate 81.

Type: Taken at *"Albatross"* station 2744, 38° 35′ N. Lat., 73° 05′ 15″ W. Long., depth 554 fms., deposited in the United States National Museum.

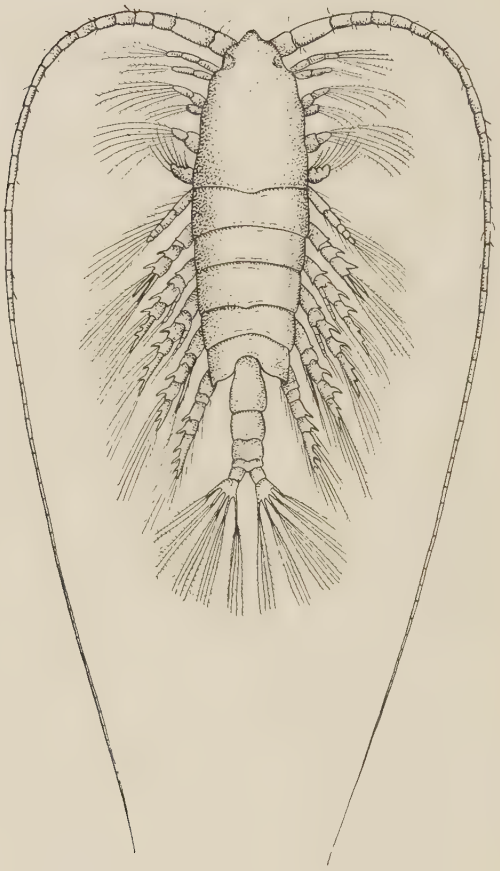
Seven specimens fastened on the back of the crab *Cancer borealis,* dredged in 1100 fms., off Miami, Florida.

Distribution: According to Dr. Pilsbry, this species is known from nineteen *"Albatross"* stations off the eastern coast of the United States, between 39° 53′ and 37° 34′ 30″ Lat. N., in depths ranging from 444 to 963 fms., chiefly on the carapace of the deep-sea crab, *Geryon quinquedons.* Also from the U. S. Fish. Commission station 1140, off Martha's Vineyard, in 374 fms. on *Geryon sp.;* from *"Albatross"* station 2237, Hampton Roads, Va., in only 12 fms., on *Geryon.* It was also taken off Key West, Florida, in 70-80 fms., by the State University of Iowa, 1923.

The *"Ara"* specimen is the greatest depth from which the species has been taken, *i.e.,* 1100 fms., and also establishes a new commensal host, *Cancer borealis,* for the species.



Poecilasma inaequilaterale Pilsbry, greatly enlarged.



Pontella plumata Dana, × 8.

Dr. Pilsbry states that he found great variation in the degree of asymmetry among the specimens from most stations; either the right or the left scutum may be the more convex. Some individuals are nearly symmetrical bilaterally.

The *"Ara"* specimens, one of the larger of which is figured, may all be considered representative of the typical form. None approaches the subspecies, *breve* Pilsbry.

TECHNICAL DESCRIPTION: The capitulum is inequilateral, oblong, the carinal margin very convex, the occludent margin slightly so. The plates have a minute sculpture of fine radial striae and low, moderately coarse concentric wrinkles. The occludent border is moderately arcuate, the greatest curvature being near its apex and base. The umbo is incurved and somewhat produced. The basal margin is short, oblique. There is only a vague trace of a curved ridge from the umbo to the junction of the carina and tergum and there are no distinct angle in the outline of the plate at the tergo-carinal suture. There is a distinct ridge extending from the umbo to the apex, nearly straight on the apical half and defining an occludent area. The tergum is small and wedge-shaped, but wider than the carina, the carinal end being truncated, or slightly rounded. The tergum is marked by radiating and growth striae. The cornea is very narrow and slender, regularly arcuate, with a narrow, rounded roof. The roof is a little wider above than near the umbo, but the sides are a bit wider below.

The peduncle is short, with prominent rings.

SYNONYMY.—*Poecilasma inaequilaterale* PILSBRY, Bull. 60, U. S. Nat. Mus., p. 85, pl. 6, figs. 6, 7, 8, 11, 12, 1907.

COPEPODA.

Family: CALANIDAE.

Subfamily: Pontellinae Dana.

Genus: PONTELLA (Dana).

Pontella plumata (Dana).

Plate 82.

DISCUSSION: A figure of the female of this exquisite minute animal is given. Brady has described and figured the species in masterly fashion in his report on the Copepoda of the *"Challenger"* Expedition.

The unusually long, dense plumose setae of the antennae and mandibles of the female are short and scarcely at all plumose in the male,

a fact which has frequently caused the male to be identified as a different species, notably as *Pontellina turgida* Dana.

Distribution: A very widely distributed pelagic species in the Atlantic and Pacific Oceans, but seldom found in great quantities.

Material examined: About a dozen females, taken in the net down about 300 fathoms, bottom depth 1400 fathoms, seven miles southwest of Cape Mala, Panama, by the *"Ara."*

Synonymy.—*Pontellina plumata* Dana, Crustacea, U. S. Explor. Exped., vol. 13, p. 1135, pl. 79, figs. 10a to d, 1852.—Giesbrecht, Bull. Mus. Comp. Zoöl., vol. 25, p. 260, 1895.

Pontellina turgida Dana (male specimen, *idem,* p. 1136, pl. 79, figs. 11a to b).

Pontella plumata G. S. Brady, Report Voyage *"Challenger,"* Zoöl., VIII, p. 92, pl. 37, figs. 1-11, 1883.

Family: **CALIGIDAE.**

Subfamily: **Pandarinae.**

Genus: **PANDARUS** Leach.

Pandarus bicolor Leach.

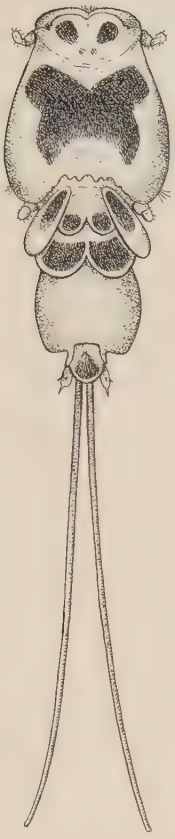
Plate 83.

Discussion: Dr. C. B. Wilson's masterly diagnosis of the European representative of this species applies with equal force to the American representatives of this species and render further description superfluous. According to Dr. Wilson, *P. bicolor* is evidently a European species, since nearly every European author mentions it, and not found on the American side of the Atlantic up to 1908.

The *"Ara"* specimens appear to be the first American record of the species and a specimen is figured for this reason. The geographic distribution of the host would make it possible and probable for this parasite to have an even greater American range than is yet known.

Material examined: About thirty-six specimens, including both sexes, found parasitic on shark, taken off Jicaron Island, Panama, January 27, 1928, by the *"Ara."* Seven specimens from tiger-shark, captured March 23, 1925. The color patterns on the mature adult specimens of both sexes are densely pigmented, while the young and immature forms are yellowish, or dirty grey as compared to the deep reddish-brown markings of the older specimens.

Synonymy.—*Pandarus bicolor* Leach, 1816, Suppl. to the fourth, fifth and sixth editions of the Encyc. Brit., 1824 (issued 1816),



Pandarus bicolor Leach, × 6.6.

p. 405, pl. XX, 2 figs.—C. B. Wilson, Proc. U. S. Nat. Mus., vol. 33, p. 400, pl. 27, 1908.

Pandarus bosci Leach, *op. cit.*, p. 406, pl. 20, 10 figs.

Pandarus fissifrons H. Milne Edwards, Hist. Nat. Crust., p. 470, 1840.

Genus: **CALIGUS** Müller.

Caligus aliuncus Wilson.

Type: The type, a female, was taken at the surface with electric light, by the *"Albatross,"* without further locality, and is deposited in the United States National Museum.

Material examined: Seven specimens taken from the outer skin of a dolphin, caught February 19, 1926, by the *"Ara."*

Distribution: Known only from the two records cited above.

Remarks: The female has been fully described and figured by Dr. C. B. Wilson. The discovery of the male of the species, taken for the first time by Mr. Vanderbilt, should prove of interest to future workers.

Mr. Vanderbilt's field-notes state that this species is coral red in color when fresh. I think that this red color may possibly be due to the ingested blood from the host, showing through the skin. The color pattern of the preserved adult specimens is dirty ocher, marked in the median portion with a definite pattern in dull brown.

Synonymy.—*Caligus aliuncus* C. B. Wilson, Proc. U. S. Nat. Mus., vol. 28, p. 576, pl. 9, 1905.

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